ATP INDEX

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ATP Grid Index to Manufacturer's Publications:

Pratt & Whitney Canada
PW305/PW305A/PW305B
Maintenance Manual

Section	Topic
	General Information
	Title Page
	Table of Contents
	List of Chapters (Table of Contents)
	Manufacturer's Introduction
	Special Tools/Fixtures and Equipment
	Consumable Materials
	Record of Revisions
	Record of Temporary Revisions
	Letter of Transmittal (Highlights of Changes)
	List of Effective Pages
	Service Bulletin List
04.00.00	Airworthiness Limitations
04.00.00	General
04.00.00	Temporary Revision No. AL-7
	Aircraft General
05.00.00	Time Limits/Maintenance Checks
05.00.00	General
05.10.00	Time Limits
05.10.00	Operating Limits and Leading Particulars
05.20.00	Scheduled Maintenance Checks
05.50.00	Unscheduled Maintenance Checks
	Power Plant
70.00.00	Standard Practices - Engines

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Section	Topic
70.00.00	General
70.00.00	Maintenance Practices
70.00.00	Removal/Installation
70.00.00	Inspection
70.00.00	Cleaning
70.00.00	Repair
71.00.00	Power Plant
71.00.00	General
71.00.00	Adjustment/Test
71.00.00	Cleaning
72.00.00	Engines
72.00.00	General
72.00.00	Description and Operation
72.00.00	Fault Isolation - 1
72.00.00	Fault Isolation - 2
72.00.00	Fault Isolation - 3 (Pre-SB24434/Post-SB24514)
72.00.00	Fault Isolation - 4 (Post-SB24434/Pre-SB24514)
72.00.00	Servicing
72.00.00	Inspection
72.30.00	Compressor Section
72.30.01	LP Compressor
72.30.01	Removal/Installation
72.30.01	Inspection
72.30.01	Repair
72.30.02	Gas Generator Case (Heavy Maintenance Only)
72.40.00	Combustion Section
72.40.01	Combustor - Removal/Installation
72.40.01	Combustor - Inspection/Check
72.50.00	Turbine Section
72.50.01	HP Turbines
72.50.01	Removal/Installation
72.50.01	Inspection/Check
72.50.02	LP Turbine Module
72.50.02	Removal/Installation
72.50.02	Inspection/Check
72.50.03	Exhaust Case - Removal/Installation
72.50.03	Exhaust Case - Inspection/Check
72.60.00	Accessory Gearbox
72.60.01	Accessory Gearbox - Maintenance Practices

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Section	Topic
72.70.00	Bypass Section
72.70.00	Bypass Ducts - Description and Operation
72.70.01	Bypass Ducts - Maintenance Practices
73.00.00	Engine Fuel and Control
73.00.00	General
73.10.00	Distribution
73.10.01	Fuel Tubes
73.10.02	Fuel Pump
73.10.03	Fuel Filter & Fuel Waste Ejector
73.10.04	Fuel Manifold
73.10.05	Fuel Shutoff and Drain
73.20.00	Controlling
73.20.01	Hydromechanical Metering Unit (HMU)
73.20.02	Electronic Engine Control (EEC)
73.20.03	Wiring Harnesses
74.00.00	Ignition
74.00.00	General
74.10.00	Electrical Power Supply
74.10.01	Ignition System
75.00.00	Air
75.00.00	General
75.10.00	Engine Anti-Icing
75.10.01	Anti-Icing Valve
75.10.02	Cabin Bleed Air
75.30.00	Compressor Control
75.30.01	Compressor Bleed Valves
75.30.02	BOV Solenoid Valve
75.30.03	P3 Tubes
75.30.04	VIGV Actuator
77.00.00	Engine Indicating
77.10.00	Power
77.10.01	Speed Sensors
77.20.00	Temperature
77.20.01	T4.5 Thermocouples
77.20.02	P1/T1 Sensors
79.00.00	Oil

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Section	Topic
79.00.00	General
79.20.00	Distribution
79.20.01	Oil Filter and Housing
79.20.02	Fuel/Oil Heat Exchanger
79.20.03	Scavenge Oil Tubes
79.20.04	Pressure Oil Tubes
79.20.05	Oil Pump Assembly
79.30.00	Indicating
79.30.01	Chip Detector
79.30.02	Oil Pressure Measuring System
79.30.03	Oil Filler Neck/Sight Glass

*** End of Index ***

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MFG.

INTRO

MAINTENANCE MANUAL

TURBOFAN ENGINE

Model(s)

PW305/PW305A/PW305B

Manual Part No. 30B1402

1 January 1991

The contents of this manual have been found acceptable to the Minister in meeting the requirements of an Engine Maintenance Manual for the Pratt & Whitney Canada PW305, PW305A and PW305B engines as required by the Canadian Airworthiness Manual, Chapter 533.4 "Instructions for Continued Airworthiness".

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Sep 12/2008

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MFG REV NO	DESCRIPTION	ISSUE DATE	ATP REV DATE	INSERTED BY
53	See Highlights	9/12/08	10/23/08	ATP/VDR
54	See Highlights	11/28/08	2/12/09	ATP/VDR
55	See Highlights	2/27/09	4/9/09	ATP/MG

RECORD OF REVISIONS

MFG REV NO	DESCRIPTION	ISSUE DATE	ATP REV DATE	INSERTED BY
26	See Highlights	11/19/99	2/17/00	ATP/GW
27	See Highlights	3/17/00	8/17/00	ATP/GM
28	See Highlights	9/1/00	11/9/00	ATP/VP
29	See Highlights	12/1/00	4/12/01	ATP/RCL
30	See Highlights	3/2/01	5/10/01	ATP/GM
31	See Highlights	6/8/01	10/25/01	ATP/MG
32	See Highlights	9/7/01	1/17/02	ATP/RCL
33	See Highlights	12/7/01	2/28/02	ATP/VP
34	See Highlights	3/8/02	5/23/02	ATP/MT
35	See Highlights	9/6/02	1/2/03	ATP/RCL
36	See Highlights	1/17/2003	4/24/2003	ATP/RLL
37	See Highlights	4/11/03	6/19/03	ATP/HW
38	See Highlights	7/11/03	10/9/03	ATP/PC
39	See Highlights	10/3/03	12/4/03	ATP/MG
40	See Highlights	2/27/04	4/28/04	ATP/RCL
41	See Highlights	4/23/04	6/23/04	ATP/VDR
42	See Highlights	7/16/04	9/29/04	ATP/MT
43	See Highlights	10/15/04	1/28/05	ATP/JSF
44	See Highlights	1/21/05	3/11/05	ATP/MB
45	See Highlights	5/6/05	7/15/05	ATP/GM
46	See Highlights	8/12/05	11/4/05	ATP/GM
47	See Highlights	11/18/05	1/18/06	ATP/GM
48	See Highlights	6/2/06	8/16/06	ATP/JSF
49	See Highlights	3/16/07	7/19/07	ATP/RCL
50	See Highlights	11/9/07	1/17/08	ATP/MG
51	See Highlights	2/15/08	4/24/08	ATP/GM
52	See Highlights	5/30/08	7/31/08	ATP/GM

RECORD OF REVISIONS

REV NO.	ISSUE DATE	DATE INSERTED	BY
1	Aug 01/91		P&WC
2	Jan 01/92		P&WC
3	May 01/92		P&WC
4	Aug 01/92		P&WC
5	Nov 01/92		P&WC
6	Dec 01/92		P&WC
7	Jun 01/93		P&WC
8	Sep 01/93		P&WC
9	Dec 01/93		P&WC
10	May 01/94		P&WC
11	Nov 01/94		P&WC
12	Mar 01/95		P&WC
13	Jul 01/95		P&WC
14	Feb 09/96		P&WC
15	May 24/96		P&WC
16	Sep 20/96		P&WC
17	Dec 02/96		P&WC
18	Sep 05/97		P&WC
19	Feb 06/98		P&WC
20	May 08/98		P&WC
21	Aug 28/98		P&WC
22	Nov 27/98		P&WC
23	Feb 26/99		P&WC
24	Jun 18/99		P&WC
25	Sep 10/99		P&WC
26	Nov 19/99		P&WC
27	Mar 17/2000		P&WC
28	Sep 01/2000		P&WC
29	Dec 01/2000		P&WC
30	Mar 02/2001		P&WC
31	Jun 08/2001		P&WC
32	Sep 07/2001		P&WC
33	Dec 07/2001		P&WC
34	Mar 08/2002		P&WC
35	Sep 06/2002		P&WC
36	Jan 17/2003		P&WC
37	Apr 11/2003		P&WC
38	Jul 11/2003		P&WC
39	Oct 03/2003		P&WC
40	Feb 27/2004		P&WC
41	Apr 23/2004		P&WC
42	Jul 16/2004		P&WC
43	Oct 15/2004		P&WC
44	Jan 21/2005		P&WC
45	May 06/2005		P&WC
46	Aug 12/2005		P&WC
47	Nov 18/2005		P&WC
48	Jun 02/2006		P&WC
49	Mar 16/2007		P&WC
50	Nov 09/2007		P&WC
51	Feb 15/2008		P&WC
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53	Sep 12/2008		P&WC
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55	Feb 27/2009		P&WC

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RECORD OF TEMPORARY REVISIONS

TEMP REV NO	DESCRIPTION	ISSUE DATE	ATP REV DATE	INSERT BY	DATE REMOVED	REV INCOR	REMOVE BY
5-18	05-20-00:5	1/30/04	3/17/04	ATP/GM	4/14/04	TR 05-20	ATP/PC
5-19	05-20-00:2	2/19/04	"	"	4/28/04	40	ATP/RCL
72-35	72-00-00:656	1/30/04	"	"	"	"	"
05-20	05-20-00:5	2/23/04	4/14/04	ATP/PC	"	"	"
5-21	05-20-00:1	12/22/04	1/28/05	ATP/JSF	3/11/05	44	ATP/MB
5-22	05-20-20:2	"	"	"	"	"	"
5-23	05-20-20:4	"	"	"	"	"	"
5-24	05-20-20:4	"	"	"	"	"	"
5-25	05-20-00:5	"	"	"	"	"	"
72-36	72-00-00:659	"	"	"	"	"	"
72-37	72-00-00:667	3/7/05	4/8/05	ATP/MT	7/15/05	45	ATP/GM
73-9	73-10-05:205	"	"	"	"	"	"
73-10	73-20-03:213	6/7/05	7/15/05	ATP/GM	11/4/05	46	ATP/GM
5-26	05-20-00:7	2/17/06	3/15/06	ATP/JSF	8/16/06	48	ATP/JSF
AL-5	Airworthiness:3	9/12/06	11/22/06	ATP/HW	7/19/07	49	ATP/RCL
AL-6	Airworthiness:6	6/14/07	7/19/07	ATP/RCL	1/17/08	50	ATP/MG
71-2	71-00-00:702	1/29/08	2/28/08	ATP/MT	4/24/08	51	ATP/GM
72-38	72-30-01:621	1/28/08	"	"	4/24/08	51	ATP/GM
72-39	72-00-00:143	6/13/08	7/31/08	ATP/GM	9/12/08	52	ATP/GM
72-40	72-00-00:1-4	6/13/08	7/31/08	ATP/GM	"	"	"
AL-7	04.00.00:1	3/31/09	5/7/09	ATP/VDR			

RECORD OF TEMPORARY REVISIONS

TR. NO.	CH/SE/SU	PAGE NO.	ISSUE DATE	INSERTED BY	DATE REMOVED	REMOVED BY
AL-1	04-00-00	1	3/31/09	ATP/VDR		

TEMPORARY REVISION INDEX

T.R. No.	Filed Adjacent to	T.R. Status
A/L-1		Incorporated at Rev. No. 8
A/L-2	Airworthiness, Page 2 Airworthiness	Incorporated at Rev. No.13
A/L-3	Airworthiness, Page 1 Airworthiness	Incorporated at Rev. No. 18
A/L-4	Airworthiness, Page 1 Airworthiness	Incorporated at Rev. No. 23
A/L-5	Airworthiness, Page 3 Airworthiness	Incorporated at Rev. No. 48
A/L-6	Airworthiness, Page 6 Airworthiness	Incorporated at Rev. No. 49
5-1		Incorporated at Rev. No. 10
5-2	05-20-00, Page 2 Scheduled Maintenance Checks	Incorporated at Rev. No. 17
5-3	05-20-00, Page1 Scheduled Maintenance Checks	Incorporated at Rev. No. 17
5-4 and 5-5 Not Issued		
5-6	05-50-00, Page 2 Unscheduled Maintenance Checks	Incorporated at Rev. No.18
5-7	05-20-00, Page 5 Scheduled Maintenance Checks	Incorporated at Rev. No. 18
5-8	05-20-00, Page 1 Scheduled Maintenance Checks	Replaced by TR5-9
5-9	05-20-00, Page 1 Scheduled Maintenance Checks	Incorporated at Rev. No. 22
5-10	05-20-00, Page 3 Scheduled Maintenance Checks	Replaced by TR5-11
5-11	05-20-00, Page 3 Scheduled Maintenance Checks	Incorporated at Rev. No. 27
5-12	05-10-00, Page 9 Operating Limits and Leading Particulars	Incorporated at Rev. No. 32
5-13	05-20-00, Page 1 Operating Limits and Leading Particulars	Incorporated at Rev. No. 34
5-14	05-20-00, Page 3 Scheduled Maintenance Checks	Incorporated at Rev. No. 37
5-15	05-20-00, Page 5, 8, 9. Scheduled Maintenance Checks	Incorporated at Rev. No. 37

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T.R. No.	Filed Adjacent to	T.R. Status
5-16	05-20-00, Page 5. Scheduled Maintenance Checks	Incorporated at Rev. No. 38
5-17	05-20-00, Page 4. Scheduled Maintenance Checks	Incorporated at Rev. No. 40
5-18	05-20-00, Page 5. Scheduled Maintenance Checks	Incorporated at Rev. No. 40
5-19	05-20-00, Page 2. Scheduled Maintenance Checks	Incorporated at Rev. No. 40
5-20	05-20-00, Page 5. Scheduled Maintenance Checks	Incorporated at Rev. No. 40
05-21	05-20-00, Page 1. Scheduled Maintenance Checks	Incorporated at Rev. No. 44
05-22	05-20-00, Page 2. Scheduled Maintenance Checks	Incorporated at Rev. No. 44
05-23	05-20-00, Page 4. Scheduled Maintenance Checks	Incorporated at Rev. No. 44
05-24	05-20-00, Page 4. Scheduled Maintenance Checks	Incorporated at Rev. No. 44
5-25	05-20-00, Page 5. Scheduled Maintenance Checks	Incorporated at Rev. No. 44
5-26	05-20-00, Page 7. Scheduled Maintenance Checks	Incorporated at Rev. No. 48
71-1	71-00-00, Page 702 Power Plant - Cleaning	Incorporated at Rev. No. 27
71-2	71-00-00, Page 702 Power Plant - Cleaning	Incorporated at Rev. No. 51
72-1, 72-2		Incorporated at Rev. No. 6
72-3		Incorporated at Rev. No. 9
72-4 thru 72-6		Incorporated at Rev. No. 10
72-7		Not Issued
72-8		Incorporated at Rev. No. 15
72-9		Incorporated at Rev. No. 15
72-10 Not Issued		
72-11		Incorporated at Rev. No. 13
72-12	72-31-01, Page 227 LP Compressor - Maintenance Practices	Incorporated at Rev. No. 16
72-13	72-31-01, Page 232 LP Compressor - Maintenance Practices	Incorporated at Rev. No. 16

P&WC Proprietary Information. Subject to the restrictions on the title page.

T.R. No.	Filed Adjacent to	T.R. Status
72-14	72-00-00, Page 625 Engine, General - Inspection	Incorporated at Rev. No. 18
72-15	72-00-00, Page 123 Fault-Isolation - 1	Incorporated at Rev. No. 18
72-16	72-40-01, Page 1 Combustor - Inspection/Check	Incorporated at Rev. No. 19
72-17	72-00-00, Page 634 Engine, General - Inspection/Check	Incorporated at Rev. No. 20
72-18	72-00-00, Page 628 Engine, General - Inspection/Check	Incorporated at Rev. No. 20
72-19	72-00-00, Page 634 Engine, General - Inspection	Incorporated at Rev. No. 22
72-20	72-00-00, Page 109 Fault Isolation - 3	Incorporated at Rev. No. 22
72-21	72-00-00, Page 137 Fault Isolation - 3	Incorporated at Rev. No. 22
72-22	72-00-00, Page 622 Engine, General - Inspection	Incorporated at Rev. No. 24
72-23	72-00-00, Page 138 Fault Isolation - 3	Incorporated at Rev. No. 26
72-24	72-00-00, Page 132 Fault Isolation - 4	Incorporated at Rev. No. 26
72-25	72-40-01, Page 602 Combustor - Inspection/Check	Incorporated at Rev. No. 27
72-26	72-50-01, Page 618 HP Turbine - Inspection/Check	Incorporated at Rev. No. 27
72-27	72-50-01, Page 622 HP Turbine - Inspection/Check	Incorporated at Rev. No. 27
72-28	72-30-01, Page 426 LP Compressor - Removal/Installation	Incorporated at Rev. No. 27
72-29	72-50-01, Page 419 HP Turbine - Removal/Installation	Incorporated at Rev. No. 30
72-30	72-50-01, Page 430 HP Turbine - Removal/Installation	Incorporated at Rev. No. 30
72-31	72-00-00, Page 111 Fault Isolation - 4 (Post SB24344)	Incorporated at Rev. No. 31
72-32	72-60-01, Page 210 Accessory Gearbox - Maintenance Practices	Incorporated at Rev. No. 31
72-33	72-60-01, Page 209 Accessory Gearbox - Maintenance Practices	Incorporated at Rev. No. 31

P&WC Proprietary Information. Subject to the restrictions on the title page.

T.R. No.	Filed Adjacent to	T.R. Status
72-34	72-00-00, Page 318 Engine - Servicing	Incorporated at Rev. No. 40
72-35	72-00-00, Page 656 Engine - Inspection	Incorporated at Rev. No. 40
72-36	72-00-00, Page 659 Engine - Inspection	Incorporated at Rev. No. 44
72-37	72-00-00, Page 667 Engine - Inspection	Incorporated at Rev. No. 45
72-38	72-30-01, Page 621 LP, Compressor Inspection	Incorporated at Rev. No. 51
72-39	72-00-00, Page 143 Fault Isolation - 3	Incorporated at Rev. No. 53
72-40	72-00-00, Page 137 Fault Isolation - 4	Incorporated at Rev. No. 53
73-1	73-10-40, Page 211 Fuel Manifold - Maintenance Practices	Incorporated at Rev. No. 18
73-2	73-10-01, Page 207 Fuel Tubes - Maintenance Practices	Incorporated at Rev. No. 19
73-3	73-10-01, Page 211 Fuel Tubes - Maintenance Practices	Incorporated at Rev. No. 19
73-4	73-10-01, Page 212 Fuel Tubes - Maintenance Practices	Incorporated at Rev. No. 19
73-5	73-10-02, Page 201 Fuel Pump - Maintenance Practices	Incorporated at Rev. No. 19
73-6	73-20-01, Page 203 Hydromechanical Metering Unit - Maintenance Practices	Incorporated at Rev. No. 19
73-7	73-20-01, Page 201 Fuel Pump - Maintenance Practices	Incorporated at Rev. No. 20
73-8	73-20-01, Page 203 Fuel Pump - Maintenance Practices	Incorporated at Rev. No. 20
73-9	73-10-05, Page 205 Fuel Shutoff and Drain - Maintenance Practices	Incorporated at Rev. No. 45
73-10	73-20-03, Page 213 Wiring Harnesses - Maintenance Practices	Incorporated at Rev. No. 46
74-1	74-10-10, Page 209 Ignition System - Maintenance Practices	Incorporated at Rev. No. 16
74- 2	74-10-10, Page 210 Ignition System - Maintenance Practices	Incorporated at Rev. No. 16

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T.R. No.	Filed Adjacent to	T.R. Status
75-1	75-30-04, Page 204 Rotary Stator Vane Actuator - Maintenance Practices	Incorporated at Rev. No. 18
75-2	75-30-04, Page 212 VIGV Actuator - Maintenance Practices	Incorporated at Rev. No. 35
75-4	75-30-04, Page 204 Rotary Stator Vane Actuator - Maintenance Practices	Incorporated at Rev. No. 37
79-1		Incorporated at Rev. No. 10

All succeeding Temporary Revisions must be retained in your printed manual until directed otherwise by subsequent revision activity.

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TABLE OF CONTENTS

SUBJECT PAGE

TITLE PAGE

REVISION HIGHLIGHTS

RECORD OF REVISIONS

RECORD OF TEMPORARY REVISIONS

LIST OF CHAPTER/SECTION/SUBJECTS

TEMPORARY REVISION INDEX

SERVICE BULLETIN LIST

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Pratt & Whitney Canada
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March 12, 2009

REVISION TRANSMITTAL SHEET

TO: Holders of the Pratt & Whitney Canada Maintenance Manual for PW305/PW305A/PW305B Engines, Manual Part No. 30B1402.

SUBJECT: Revision No. 55, dated Feb 27/2009

Please insert the attached Revision No. 55 pages into your copy of the PW305/PW305A/PW305B Maintenance Manual. Remove and destroy superseded pages.

Extreme care should be exercised in updating your copy of the manual. To ensure that you do not inadvertently discard pages that should be retained, the manual should be updated in accordance with the Lists of Effective Pages.

Pages supplied with the new date and revision bars but no visible change may contain coding changes transparent to the user and should be inserted as part of the revision.

Please add Revision No. 55 to the Record of Revisions.

Any discrepancies, problems or suggestions regarding this revision should be forwarded in writing using the Pratt & Whitney Canada Customer Feedback Sheet (RSVP), and directed to:

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www.pwc.ca/en/3_0/3_0_6/3_0_6_5_7.asp.

PW305/PW305A/PW305B MAINTENANCE MANUAL
REVISION NO. 55 HIGHLIGHTS

CH/SE/SU	Description of Change
Service Bulletin List	Service Bulletin 24608 has been incorporated.
	Service Bulletin list has been updated to add SB24281R2.
	Service Bulletin list has been updated to add SB24607R0.
	Service Bulletin list has been updated to add SB24605R0.
	Service Bulletin list has been updated to add SB24578R1.
	Service Bulletin list has been updated to add SB24606.
72-00-00 Fault Isolation2	List of Figures The fault isolation chart for fault code 2K has been revised to add additional troubleshooting tips.
72-00-00 Inspection	General The eddy current inspection procedure for blades has been revised to add that EDU download was required only when a crack is found.
72-30-01 Removal Installation	Special-tools Tool Service Bulletin PW300-417 has been incorporated. Tool Service Bulletin PW300-412 has been incorporated. Tool Service Bulletin PW300-201 has been incorporated. Removal Tool Service Bulletin PW300-412 has been incorporated. Fan Balancing Assembly Tool Service Bulletin PW300-201 has been incorporated. Removal Tool Service Bulletin PW300-417 has been incorporated. Tool Service Bulletin PW300-412 has been incorporated.
72-50-01 Removal Installation	Special-tools Tool Service Bulletin PW300-392 has been incorporated. Tool Service Bulletin PW300-417 has been incorporated. Tool Service Bulletin PW300-201 has been incorporated. Tool Service Bulletin PW300-412 has been incorporated. Removal of HP Turbine Disk Tool Service Bulletin PW300-417 has been incorporated. Tool Service Bulletin PW300-412 has been incorporated. Procedure Tool Service Bulletin PW300-412 has been incorporated.

PW305/PW305A/PW305B MAINTENANCE MANUAL
REVISION NO. 55 HIGHLIGHTS

CH/SE/SU	Description of Change
	Removal
	Tool Service Bulletin PW300-392 has been incorporated.
	Assemble HP Turbine Module
	Tool Service Bulletin PW300-412 has been incorporated.
	HP Turbine Module Installation
	Tool Service Bulletin PW300-412 has been incorporated.
	Installation of HP Turbine Retaining Nut (Alternate)
	Tool Service Bulletin PW300-201 has been incorporated.
72-50-01 Inspection	First-stage HP Turbine Disk Assembly
	Procedure for inspection of first-stage HP turbine disk assembly was modified.
	Turbine Disk Assembly Inspection
	Procedure for inspection of second stage HP turbine disk assembly was modified.
	Visually Check HP Turbine Baffle
	Procedure for inspection of HPT shroud housing assembly was modified.
	Visual Checks
	Procedure for first and second-stage stator seal rings was modified.
	Visual Checks
	Procedure for inspection of turbine vane retaining plate was modified.
	Visual Checks
	Procedure for hot section inspection of HP turbine vane ring segments was modified.
	Vane Ring Assembly
	Procedure for hot section inspection of second stage turbine vane ring assembly was modified.
72-50-02 Removal Installation	Special-tools
	Tool Service Bulletin PW300-666 has been incorporated.
	Tool Service Bulletin PW300-412 has been incorporated.
	Tool Service Bulletin PW300-201 has been incorporated.
	Installation
	Tool Service Bulletin PW300-666 has been incorporated.

PW305/PW305A/PW305B MAINTENANCE MANUAL
REVISION NO. 55 HIGHLIGHTS

CH/SE/SU	Description of Change
	Tool Service Bulletin PW300-412 has been incorporated.
	LP Turbine Module
	Tool Service Bulletin PW300-412 has been incorporated.
	Installation
	Tool Service Bulletin PW300-666 has been incorporated.
72-50-03 Removal Installation	Consumables
	The consumable materials list has been updated to add PWC011-014B.
	Special-tools
	The special tools list has been updated to add PWC40538,PWC69269 and PWC89835.
	Exhaust Case
	No. 4 bearing seal carrier assembly procedure has been revised to add freezing of carbon seal (RSVP33903).
	Installation of No. 4 Bearing Seal Carrier
	Installation of No. 4 bearing seal carrier procedure has been updated.
79-30-03 Maintenance Practices	Oil Filler Neck (Pre-SB24021)
	Service Bulletin 24608 has been incorporated.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
Title Page		Sep 12/2008
Record of Revisions		Jan 01/91
Record of Temporary Revisions		Jan 01/91
LEP	1	Feb 27/2009
	2 blank	Feb 27/2009
List of Chapter/ Section/Subjects	1	Nov 19/99
	2	Nov 19/99
	3	Nov 19/99
	4 blank	Nov 19/99
Temporary Revision Index	1	Sep 12/2008
	2	Sep 12/2008
	3	Sep 12/2008
	4	Sep 12/2008
	5	Sep 12/2008
	6 blank	Sep 12/2008
Service Bulletin List	1	Feb 27/2009
	2	Feb 27/2009
	3	Feb 27/2009
	4	Feb 27/2009
	5	Feb 27/2009
	6	Feb 27/2009
	7	Feb 27/2009
	8	Feb 27/2009
	9	Feb 27/2009
	10	Feb 27/2009
	11	Feb 27/2009
	12	Feb 27/2009

P&WC Proprietary Information. Subject to the restrictions on the title page.

SERVICE BULLETIN LIST

This list identifies all applicable Service Bulletins (SB's) that have been reviewed and incorporated or have no effect on this manual. Bulletins considered to have no effect on manual text have the words "No Effect" added; effective Bulletins give the date incorporated in the manual.

The ATA SB No. for the SB's listed here is the P&WC SB No., prefixed with PW300-72-. To reduce repetition, the ATA numbers are shown as NA unless the ATA number does not follow this convention.

The incorporation of SB's on each engine is recorded in the engine log book and related documents.

For a current set of all PW305 Series SB's (Engine Model Group #15) use ordering number 30B1404.

P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24001	NA	1	PW305, PW305A, PW305B	Aug 01/91
24002	NA	1	PW305, PW305A, PW305B	Aug 01/91
24003	NA	1	PW305, PW305A, PW305B	Aug 01/91
24004	NA	1	PW305, PW305A, PW305B	Aug 01/91
24005	NA	Orig.	PW305	No Effect
24006	NA	Orig.	PW305	No Effect
24007	NA	Orig.	PW305	No Effect
24008	NA	Orig.	PW305	No Effect
24009	NA	Orig.	PW305	No Effect
24010	NA	1	PW305	No Effect
24011	NA	Orig.	PW305	Dec 01/92
24012	NA	Orig.	PW305	No Effect
24013	NA	1	PW305	May 01/92
24014	NA	Orig.	PW305	May 01/92
24016	NA	1	PW305	No Effect
24017	NA	Orig.	PW305	No Effect
24018	NA	Orig.	PW305	No Effect
24019	NA	Orig.	PW305	No Effect
24020	NA	Orig.	PW305	No Effect
24021	NA	1	PW305	Dec 07/01
24022	NA	Orig.	PW305	No Effect
24023	NA	Orig.	PW305	No Effect
24024	NA	Orig.	PW305	No Effect
24025	NA	3	PW305	No Effect
24026	NA	Orig.	PW305	Sep 01/93
24027	NA	1	PW305	No Effect
24028	NA	Orig.	PW305	No Effect
24029	NA	Orig.	PW305	No Effect
24030	NA	Orig.	PW305	May 01/92
24031	NA	1	PW305	No Effect

P&WC Proprietary Information. Subject to the restrictions on the title page.

P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24032	NA	Orig.	PW305	No Effect
24033	NA	Orig.	PW305	No Effect
24034	NA	1	PW305	No Effect
24035	NA	Orig.	PW305	No Effect
24036	NA	Orig.	PW305	No Effect
24037	NA	Orig.	PW305	Aug 01/92
24038	NA	Orig.	PW305	May 01/92
24039	NA	Orig.	PW305	May 01/92
24040	NA	Orig.	PW305	No Effect
24041	NA	Orig.	PW305	Dec 01/92
24042	NA	Orig.	PW305	No Effect
24043	NA	Orig.	PW305	No Effect
24044	NA	Orig.	PW305	No Effect
24045	NA	Orig.	PW305	No Effect
24046	NA	Orig.	PW305	No Effect
24047	NA	Orig.	PW305	No Effect
24048	NA	Orig.	PW305	No Effect
24049	NA	Orig.	PW305	No Effect
24050	NA	Orig.	PW305	May 01/92
24051	NA	Orig.	PW305	No Effect
24052	NA	Orig.	PW305	No Effect
24053	NA	Orig.	PW305	May 01/92
24054	NA	Orig.	PW305	No Effect
24055	NA	1	PW305	No Effect
24056	NA	Orig.	PW305	No Effect
24057	NA	1	PW305	No Effect
24058	NA	Orig.	PW305	No Effect
24059	NA	Orig.	PW305	Aug 01/92
24060	NA	Orig.	PW305	Aug 01/92
24061	NA	Orig.	PW305	Aug 01/92
24062	NA	1	PW305	Jul 11/03
24063	NA	Orig.	PW305	Dec 01/92
24064	NA	Orig.	PW305	No Effect
24065	NA	Orig.	PW305	Dec 01/92
24066	NA	Orig.	PW305	No Effect
24067	NA	Orig.	PW305	No Effect
24068	NA	Orig.	PW305	No Effect
24069	NA	Orig.	PW305	No Effect
24070	NA	Orig.	PW305	No Effect
24071	NA	Orig.	PW305	No Effect
24072	NA	Orig.	PW305	May 01/92
24073	NA	Orig.	PW305	No Effect
24074	NA	1	PW305	No Effect
24075	NA	Orig.	PW305	Aug 01/92

P&WC Proprietary Information. Subject to the restrictions on the title page.

P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24076	NA	Orig.	PW305	No Effect
24077	NA	Orig.	PW305, PW305A, PW305B	No Effect
24078	NA	1	PW305A, PW305B	No Effect
24079	NA	Orig.	PW305	Aug 01/92
24080	NA	Orig.	PW305	No Effect
24081	NA	Orig.	PW305	No Effect
24082	NA	Orig.	PW305	No Effect
24083	NA	Orig.	PW305	Jan 01/92
24084	NA	Orig.	PW305	Aug 01/92
24085	NA	Orig.	PW305	No Effect
24086	NA	Orig.	PW305	Sep 01/93
24087	NA	Orig.	PW305	Sep 01/93
24088	NA	Orig.	PW305	Sep 01/93
24089	NA	Orig.	PW305	Sep 01/93
24090	NA	Orig.	PW305	No Effect
24091	NA	Orig.	PW305	No Effect
24092	NA	Orig.	PW305	No Effect
24093	NA	Orig.	PW305	Dec 01/93
24094	NA	Orig.	PW305	No Effect
24095	NA	1	PW305	No Effect
24096	NA	Orig.	PW305	No Effect
24097	NA	Orig.	PW305	No Effect
24098	NA	1	PW305A, PW305B	No Effect
24099	NA	Orig.	PW305	No Effect
24100	NA	Orig.	PW305	No Effect
24101	NA	1	PW305	No Effect
24102	NA	1	PW305	Jul 11/03
24103	NA	Orig.	PW305	Dec 01/92
24105	NA	Orig.	PW305	No Effect
24106	NA	Orig.	PW305	No Effect
24107	NA	Orig.	PW305	No Effect
24108	NA	Orig.	PW305	No Effect
24109	NA	Orig.	PW305	No Effect
24110	NA	1	PW305, PW305A, PW305B	No Effect
24111	NA	1	PW305	No Effect
24112	NA	Orig.	PW305	No Effect
24113	NA	Orig.	PW305	No Effect
24114	NA	Orig.	PW305	No Effect
24115	NA	1	PW305, PW305A, PW305B	Sep 01/93
24116	NA	Orig.	PW305	No Effect
24117	NA	Orig.	PW305	Aug 01/92
24118	NA	Orig.	PW305	Dec 07/01
24119	NA	Orig.	PW305	No Effect
24120	NA	Orig.	PW305	No Effect

P&WC Proprietary Information. Subject to the restrictions on the title page.

P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24121	NA	Orig.	PW305	No Effect
24122	NA	1	PW305	No Effect
24123	NA	Orig.	PW305	No Effect
24124	NA	Orig.	PW305	No Effect
24125	NA	Orig.	PW305	No Effect
24126	NA	Orig.	PW305	No Effect
24127	NA	Orig.	PW305	No Effect
24128	NA	1	PW305	Sep 01/93
24129	NA	Orig.	PW305	No Effect
24130	NA	Orig.	PW305	No Effect
24131	NA	Orig.	PW305, PW305A, PW305B	Nov 01/94
24132	NA	Orig.	PW305, PW305A, PW305B	No Effect
24133	NA	Orig.	PW305, PW305A, PW305B	No Effect
24134	NA	1	PW305	Jul 11/03
24135	NA	1	PW305A, PW305B	Feb 06/98
24136	NA	1	PW305A	Nov 09/07
24137	NA	Orig.	PW305	Sep 01/93
24138	NA	Orig.	PW305	Dec 01/92
24139	NA	Orig.	PW305A, PW305B	No Effect
24140	NA	1	PW305A, PW305B	No Effect
24141	NA	Orig.	PW305	No Effect
24142	NA	Orig.	PW305	No Effect
24144	NA	Orig.	PW305	Dec 01/92
24145	NA	Orig.	PW305	Dec 01/92
24146	NA	Orig.	PW305	Sep 01/93
24147	NA	Orig.	PW305	No Effect
24148	NA	Orig.	PW305	No Effect
24149	NA	Orig.	PW305	No Effect
24150	NA	Orig.	PW305	No Effect
24151	NA	Orig.	PW305	No Effect
24152	NA	Orig.	PW305, PW305A	Dec 01/92
24153	NA	Orig.	PW305, PW305A, PW305B	No Effect
24154	NA	Orig.	PW305	Sep 01/93
24155	NA	1	PW305	No Effect
24156	NA	1	PW305, PW305A	Dec 01/92
24157	NA	Orig.	PW305	No Effect
24158	NA	Orig.	PW305	No Effect
24159	NA	Orig.	PW305	Sep 01/93
24160	NA	Orig.	PW305	No Effect
24162	NA	Orig.	PW305, PW305A	No Effect
24163	NA	Orig.	PW305, PW305A, PW305B	No Effect
24164	NA	Orig.	PW305, PW305A, PW305B	Sep 01/93
24165	NA	Orig.	PW305	No Effect
24166	NA	Orig.	PW305, PW305A, PW305B	No Effect

P&WC Proprietary Information. Subject to the restrictions on the title page.

P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24167	NA	Orig.	PW305, PW305A, PW305B	No Effect
24168	NA	Orig.	PW305	No Effect
24169	NA	Orig.	PW305	No Effect
24170	NA	Orig.	PW305	No Effect
24171	NA	Orig.	PW305, PW305A, PW305B	Nov 01/94
24172	NA	Orig.	PW305, PW305A, PW305B	No Effect
24173	NA	Orig.	PW305, PW305A, PW305B	No Effect
24174	NA	5	PW305, PW305A, PW305B	May 12/06
24175	NA	Orig.	PW305, PW305A, PW305B	No Effect
24176	NA	2	PW305, PW305A, PW305B	No Effect
24177	NA	Orig.	PW305, PW305A, PW305B	May 06/2005
24178	NA	1	PW305	Dec 01/93
24179	NA	3	PW305, PW305A, PW305B	No Effect
24180	NA	1	PW305, PW305A, PW305B	No Effect
24182	NA	Orig.	PW305, PW305A, PW305B	No Effect
24183	NA	2	PW305, PW305A, PW305B	No Effect
24184	NA	Orig.	PW305	No Effect
24185	NA	Orig.	PW305, PW305A, PW305B	No Effect
24186	NA	Orig.	PW305, PW305A, PW305B	No Effect
24187	NA	3	PW305, PW305A, PW305B	No Effect
24188	NA	1	PW305, PW305A, PW305B	No Effect
24189	NA	2	PW305	No Effect
24190	NA	2	PW305, PW305A, PW305B	Sep 01/93
24191	NA	Orig.	PW305, PW305A, PW305B	No Effect
24192	NA	Orig.	PW305, PW305A, PW305B	No Effect
24194	NA	Orig.	PW305, PW305A, PW305B	No Effect
24195	NA	1	PW305, PW305A, PW305B	No Effect
24197	NA	Orig.	PW305, PW305A, PW305B	May 01/94
24198	NA	Orig.	PW305, PW305A, PW305B	Nov 01/94
24199	NA	Orig.	PW305, PW305A, PW305B	No Effect
24200	NA	1	PW305, PW305A, PW305B	No Effect
24201	NA	Orig.	PW305, PW305A, PW305B	No Effect
24202	NA	3	PW305A, PW305B	Sep 01/00
24203	NA	2	PW305, PW305A, PW305B	No Effect
24204	NA	4	PW305, PW305A, PW305B	No Effect
24205	NA	Orig.	PW305, PW305A, PW305B	No Effect
24206	NA	Orig.	PW305, PW305A, PW305B	No Effect
24207	NA	Orig.	PW305, PW305A, PW305B	No Effect
24208	NA	Orig.	PW305, PW305A, PW305B	No Effect
24209	NA	Orig.	PW305, PW305A, PW305B	No Effect
24210	NA	Orig.	PW305, PW305A, PW305B	No Effect
24211	NA	Orig.	PW305, PW305A, PW305B	No Effect
24212	NA	2	PW305, PW305A, PW305B	No Effect
24213	NA	1	PW305, PW305A, PW305B	No Effect

P&WC Proprietary Information. Subject to the restrictions on the title page.

P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24214	NA	1	PW305, PW305A, PW305B	No Effect
24215	NA	Orig.	PW305, PW305A, PW305B	No Effect
24216	NA	Orig.	PW305, PW305A, PW305B	No Effect
24217	NA	Orig.	PW305, PW305A, PW305B	No Effect
24218	NA	1	PW305, PW305A, PW305B	No Effect
24219	NA	Orig.	PW305, PW305A, PW305B	No Effect
24220	NA	Orig.	PW305, PW305A, PW305B	No Effect
24221	NA	Orig.	PW305, PW305A, PW305B	No Effect
24223	NA	Orig.	PW305, PW305A, PW305B	No Effect
24224	NA	1	PW305	No Effect
24225	NA	Orig.	PW305, PW305A, PW305B	No Effect
24226	NA	1	PW305, PW305A, PW305B	No Effect
24227	NA	3	PW305, PW305A, PW305B	No Effect
24228	NA	Orig.	PW305	Sep 01/93
24229	NA	Orig.	PW305	No Effect
24230	NA	1	PW305, PW305A, PW305B	Sep 01/93
24231	NA	Orig.	PW305, PW305A, PW305B	No Effect
24232	NA	Orig.	PW305, PW305A, PW305B	No Effect
24233	NA	Orig.	PW305, PW305A, PW305B	No Effect
24234	NA	Orig.	PW305, PW305A, PW305B	No Effect
24235	NA	Orig.	PW305, PW305A, PW305B	No Effect
24236	NA	Orig.	PW305, PW305A, PW305B	No Effect
24237	NA	Orig.	PW305A, PW305B	No Effect
24238	NA	Orig.	PW305, PW305A, PW305B	No Effect
24239	NA	Orig.	PW305, PW305A, PW305B	No Effect
24240	NA	Orig.	PW305, PW305A, PW305B	No Effect
24241	NA	1	PW305A, PW305B	No Effect
24242	NA	Orig.	PW305, PW305A, PW305B	No Effect
24243	NA	Orig.	PW305, PW305A, PW305B	Sep 01/93
24244	NA	2	PW305, PW305A, PW305B	No Effect
24245	NA	1	PW305, PW305A, PW305B	No Effect
24246	NA	Orig.	PW305, PW305A, PW305B	No Effect
24247	NA	Orig.	PW305, PW305A, PW305B	No Effect
24248	NA	2	PW305, PW305A, PW305B	No Effect
24249	NA	Orig.	PW305, PW305A, PW305B	No Effect
24250	NA	Orig.	PW305, PW305A, PW305B	No Effect
24251	NA	Orig.	PW305, PW305A, PW305B	Sep 01/93
24252	NA	Orig.	PW305, PW305A, PW305B	No Effect
24253	NA	Orig.	PW305, PW305A, PW305B	No Effect
24254	NA	Orig.	PW305, PW305A, PW305B	No Effect
24255	NA	Orig.	PW305, PW305A, PW305B	No Effect
24256	NA	Orig.	PW305A, PW305B	No Effect
24257	NA	Orig.	PW305, PW305A, PW305B	No Effect
24258	NA	Orig.	PW305, PW305A, PW305B	No Effect

P&WC Proprietary Information. Subject to the restrictions on the title page.

P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24259	NA	Orig.	PW305, PW305A, PW305B	No Effect
24260	NA	1	PW305, PW305A, PW305B	No Effect
24262	NA	Orig.	PW305, PW305A, PW305B	No Effect
24263	NA	Orig.	PW305, PW305A, PW305B	Sep 01/93
24264	NA	Orig.	PW305, PW305A, PW305B	No Effect
24265	NA	2	PW305, PW305A, PW305B	No Effect
24266	NA	1	PW305, PW305A, PW305B	No Effect
24267	NA	Orig.	PW305, PW305A, PW305B	No Effect
24268	NA	Orig.	PW305A, PW305B	No Effect
24269	NA	Orig.	PW305, PW305A, PW305B	Apr 23/04
24270	NA	Orig.	PW305, PW305A, PW305B	No Effect
24271	NA	Orig.	PW305, PW305A, PW305B	No Effect
24272	NA	Orig.	PW305, PW305A, PW305B	No Effect
24273	NA	Orig.	PW305, PW305A, PW305B	No Effect
24274	NA	Orig.	PW305A	Dec 01/93
24275	NA	Orig.	PW305, PW305A, PW305B	No Effect
24276	NA	Orig.	PW305, PW305A, PW305B	Jun 08/01
24277	NA	Orig.	PW305, PW305A, PW305B	No Effect
24278	NA	Orig.	PW305 PW305A PW305B	No Effect
24279	NA	Orig.	PW305A, PW305B	Apr 23/04
24280	NA	2	PW305, PW305A, PW305B	No Effect
24281	NA	2	PW305A, PW305B	No Effect
24282	NA	Orig.	PW305, PW305A, PW305B	No Effect
24283	NA	Orig.	PW305, PW305A, PW305B	Oct 19/01
24284	NA	Orig.	PW305, PW305A, PW305B	No Effect
24286	NA	Orig.	PW305, PW305A, PW305B	No Effect
24287	NA	Orig.	PW305, PW305A, PW305B	Jul 01/95
24288	NA	Orig.	PW305, PW305A, PW305B	No Effect
24289	NA	Orig.	PW305, PW305A, PW305B	No Effect
24290	NA	Orig.	PW305, PW305A, PW305B	No Effect
24291	NA	1	PW305, PW305A, PW305B	No Effect
24292	NA	Orig.	PW305, PW305A, PW305B	No Effect
24293	NA	3	PW305A, PW305B	No Effect
24294	NA	Orig.	PW305, PW305A, PW305B	No Effect
24295	NA	Orig.	PW305, PW305A, PW305B	Jul 01/95
24297	NA	Orig.	PW305, PW305A, PW305B	No Effect
24298	NA	Orig.	PW305, PW305A, PW305B	Nov 03/06
24299	NA	Orig.	PW305, PW305A, PW305B	Jul 01/95
24300	NA	Orig.	PW305A, PW305B	No Effect
24301	NA	Orig.	PW305, PW305A, PW305B	No Effect
24302	NA	Orig.	PW305, PW305A, PW305B	No Effect
24303	NA	1	PW305, PW305A, PW305B	Nov 01/94
24304	NA	Orig.	PW305, PW305A, PW305B	No Effect
24305	NA	Orig.	PW305, PW305A, PW305B	No Effect

P&WC Proprietary Information. Subject to the restrictions on the title page.

P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24306	NA	4	PW305, PW305A, PW305B	No Effect
24307	NA	1	PW305, PW305A, PW305B	No Effect
24308	NA	Orig.	PW305, PW305A, PW305B	No Effect
24309	NA	Orig.	PW305, PW305A, PW305B	June 20/06
24310	NA	Orig.	PW305, PW305A, PW305B	No Effect
24311	NA	Orig.	PW305, PW305A, PW305B	No Effect
24312	NA	2	PW305A, PW305B	Nov 19/99
24313	NA	Orig.	PW305A, PW305B	No Effect
24314	NA	1	PW305A, PW305B	No Effect
24315	NA	Orig.	PW305A, PW305B	No Effect
24316	NA	7	PW305A, PW305B	No Effect
24317	NA	Orig.	PW305, PW305A, PW305B	Nov 01/94
24318	NA	1	PW305B	No Effect
24319	NA	Orig.	PW305, PW305A, PW305B	No Effect
24320	NA	Orig.	PW305A	No Effect
24321	NA	Orig.	PW305, PW305A, PW305B	No Effect
24322	NA	Orig.	PW305B	No Effect
24323	NA	Orig.	PW305A, PW305B	No Effect
24324	NA	Orig.	PW305, PW305A, PW305B	No Effect
24327	NA	Orig.	PW305A, PW305B	No Effect
24329	NA	1	PW305A, PW305B	No Effect
24330	NA	1	PW305A, PW305B	No Effect
24332	NA	1	PW305A, PW305B	No Effect
24333	NA	2	PW305, PW305A, PW305B	No Effect
24334	NA	4	PW305A, PW305B	No Effect
24335	NA	Orig.	PW305A, PW305B	No Effect
24336	NA	2	PW305A, PW305B	No Effect
24337	NA	1	PW305B	Jul 01/95
24338	NA	Orig.	PW305A, PW305B	No Effect
24340	NA	1	PW305A, PW305B	No Effect
24341	NA	2	PW305A, PW305B	Apr 23/04
24342	NA	2	PW305A, PW305B	No Effect
24344	NA	1	PW305A, PW305B	June 27/06
24346	NA	Orig.	PW305A, PW305B	No Effect
24347	NA	8	PW305A, PW305B	No Effect
24348	NA	Orig.	PW305B	Dec 07/01
24350	NA	Orig.	PW305A, PW305B	No Effect
24351	NA	Orig.	PW305A, PW305B	No Effect
24352	NA	Orig.	PW305A, PW305B	No Effect
24353	NA	Orig.	PW305A, PW305B	No Effect
24354	NA	Orig.	PW305A, PW305B	No Effect
24357	NA	1	PW305A, PW305B	No Effect
24358	NA	Orig.	PW305A, PW305B	No Effect
24359	NA	Orig.	PW305A, PW305B	No Effect

P&WC Proprietary Information. Subject to the restrictions on the title page.

P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24360	NA	Orig.	PW305B	Dec 07/01
24361	NA	Orig.	PW305A, PW305B	No Effect
24362	NA	1	PW305A, PW305B	No Effect
24363	NA	2	PW305A, PW305B	No Effect
24364	NA	Orig.	PW305A, PW305B	No Effect
24365	NA	1	PW305A, PW305B	No Effect
24366	NA	Orig.	PW305A, PW305B	No Effect
24367	NA	Orig.	PW305A, PW305B	Aug 28/98
24368	NA	Orig.	PW305A, PW305B	No Effect
24369	NA	2	PW305A, PW305B	Mar 16/07
24370	NA	1	PW305A, PW305B	No Effect
24372	NA	2	PW305B	Nov 09/07
24373	NA	Orig.	PW305A, PW305B	No Effect
24374	NA	Orig.	PW305A	No Effect
24375	NA	Orig.	PW305A, PW305B	No Effect
24376	NA	Orig.	PW305A, PW305B	No Effect
24377	NA	Orig.	PW305A, PW305B	No Effect
24378	NA	Orig.	PW305A, PW305B	No Effect
24379	NA	4	PW305A, PW305B	No Effect
24381	NA	1	PW305A, PW305B	No Effect
24382	NA	Orig.	PW305A	No Effect
24383	NA	3	PW305A, PW305B	No Effect
24384	NA	Orig.	PW305A, PW305B	No Effect
24385	NA	Orig.	PW305A, PW305B	No Effect
24386	NA	Orig.	PW305A, PW305B	No Effect
24387	NA	Orig.	PW305A, PW305B	No Effect
24388	NA	Orig.	PW305A, PW305B	No Effect
24389	NA	Orig.	PW305A, PW305B	No Effect
24390	NA	Orig.	PW305A, PW305B	No Effect
24391	NA	Orig.	PW305A, PW305B	No Effect
24393	NA	Orig.	PW305A, PW305B	No Effect
24394	NA	1	PW305A, PW305B	No Effect
24395	NA	2	PW305A, PW305B	Dec 07/01
24396	NA	Orig.	PW305A, PW305B	No Effect
24398	NA	Orig.	PW305A, PW305B	No Effect
24400	NA	1	PW305A, PW305B	No Effect
24402	NA	Orig.	PW305A, PW305B	No Effect
24403	NA	Orig.	PW305A, PW305B	No Effect
24404	NA	1	PW305A, PW305B	No Effect
24405	NA	Orig.	PW305A, PW305B	No Effect
24406	NA	Orig.	PW305A, PW305B	No Effect
24407	NA	Orig.	PW305A, PW305B	No Effect
24408	NA	Orig.	PW305A, PW305B	No Effect
24409	NA	Orig.	PW305A, PW305B	No Effect

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P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24410	NA	Orig.	PW305A, PW305B	No Effect
24411	NA	3	PW305A, PW305B	Feb 06/98
24412	NA	Orig.	PW305A, PW305B	No Effect
24413	NA	Orig.	PW305A, PW305B	No Effect
24414	NA	Orig.	PW305A, PW305B	Mar 08/02
24417	NA	Orig.	PW305A, PW305B	No Effect
24418	NA	1	PW305A, PW305B	No Effect
24419	NA	3	PW305A, PW305B	Sep 05/97
24420	NA	Orig.	PW305A, PW305B	Feb 06/98
24421	NA	Orig.	PW305A	No Effect
24422	NA	3	PW305A	No Effect
24423	NA	Orig.	PW305A, PW305B	No Effect
24424	NA	Orig.	PW305A, PW305B	No Effect
24425	NA	2	PW305A, PW305B	Nov 09/07
24426	NA	Orig.	PW305A, PW305B	No Effect
24428	NA	2	PW305A, PW305B	No Effect
24430	NA	4	PW305A, PW305B	No Effect
24431	NA	Orig.	PW305A, PW305B	No Effect
24432	NA	1	PW305A, PW305B	No Effect
24435	NA	4	PW305A, PW305B	No Effect
24436	NA	1	PW305A, PW305B	No Effect
24437	NA	1	PW305A, PW305B	No Effect
24439	NA	2	PW305A	Sep 06/02
24444	NA	1	PW305a, PW305B	No Effect
24445	NA	2	PW305a, PW305B	No Effect
24448	NA	Orig.	PW305a, PW305B	No Effect
24450	NA	1	PW305a, PW305B	No Effect
24453	NA	2	PW305a, PW305B	Nov 18/2005
24454	NA	Orig.	PW305A, PW305B	Jun 18/99
24455	NA	1	PW305A, PW305B	Oct 28/2005
24464	NA	Orig.	PW305A, PW305B	No Effect
24465	NA	3	PW305A, PW305B	No Effect
24470	NA	1	PW305A, PW305B	No Effect
24471	NA	1	PW305A, PW305B	No Effect
24472	NA	1	PW305A, PW305B	No Effect
24473	NA	Orig.	PW305A, PW305B	Dec 07/01
24474	NA	1	PW305A, PW305B	No Effect
24480	NA	1	PW305A	No Effect
24481	NA	1	PW305A, PW305B	No Effect
24482	NA	1	PW305A, PW305B	No Effect
24483	NA	1	PW305A, PW305B	No Effect
24484	NA	3	PW305A, PW305B	No Effect
24485	NA	Orig.	PW305A, PW305B	Nov 09/07
24486	NA	1	PW305A, PW305B	No Effect

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P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24488	NA	Orig.	PW305A, PW305B	No Effect
24490	NA	1	PW305B	Nov 09/07
24491	NA	Orig.	PW305A, PW305B	No Effect
24492	NA	Orig.	PW305A, PW305B	No Effect
24494	NA	1	PW305A, PW305B	No Effect
24496	NA	1	PW305A, PW305B	Jun 02/2006
24498	NA	Orig.	PW305A, PW305B	No Effect
24499	NA	1	PW305A, PW305B	No Effect
24500	NA	Orig.	PW305A, PW305B	No Effect
24501	NA	Orig.	PW305A	No Effect
24502	NA	1	PW305A, PW305B	Mar 16/07
24503	NA	2	PW305A, PW305B	No Effect
24504	NA	2	PW305A, PW305B	Mar 16/07
24505	NA	Orig.	PW305A	No Effect
24508	NA	2	PW305A, PW305B	No Effect
24507	NA	1	PW305A	Apr 11/03
24509	NA	Orig.	PW305A	No Effect
24510	NA	Orig.	PW305A, PW305B	No Effect
24513	NA	Orig.	PW305A, PW305B	Nov 09/07
24515	NA	Orig.	PW305A	No Effect
24516	NA	1	PW305A	Nov 09/07
24517	NA	1	PW305A, PW305B	No Effect
24519	NA	1	PW305A, PW305B	No Effect
24521	NA	7	PW305B	Aug 10/2006
24522	NA	1	PW305A	No Effect
24523	NA	1	PW305A, PW305B	No Effect
24525	NA	Orig.	PW305A, PW305B	Jul 11/03
24529	NA	3	PW305A, PW305B	No Effect
24530	NA	3	PW305A	No Effect
24531	NA	Orig.	PW305A, PW305B	Nov 03/06
24534	NA	Orig.	PW305A, PW305B	No Effect
24535	NA	3	PW305A, PW305B	No Effect
24537	NA	1	PW305A, PW305B	No Effect
24540	NA	1	PW305A, PW305B	No Effect
24541	NA	2	PW305A	No Effect
24542	NA	Orig.	PW305A	Nov 09/07
24544	NA	Orig.	PW305A	June 20/06
24545	NA	1	PW305b	No Effect
24546	NA	2	PW305b	May 30/2008
24547	NA	Orig.	PW305A, PW305B	Jan 21/2005
24550	NA	1	PW305A, PW305B	No Effect
24551	NA	Orig.	PW305A	No Effect
24552	NA	Orig.	PW305A, PW305B	No Effect
24553	NA	Orig.	PW305A	No Effect

P&WC Proprietary Information. Subject to the restrictions on the title page.

P&WC SB No.	ATA SB No.	Rev. No.	Engine Model Applicability	Effect/Date Incorporated
24554	NA	Orig.	PW305B	No Effect
24556	NA	Orig.	PW305A	No Effect
24561	NA	Orig.	PW305A, PW305B	No Effect
24563	NA	2	PW305A, PW305B	No Effect
24564	NA	2	PW305A, PW305B	May 30/2008
24565	NA	Orig.	PW305A, PW305B	May 30/2008
24569	NA	Orig.	PW305A	No Effect
24571	NA	Orig.	PW305A, PW305B	No Effect
24572	NA	1	PW305A, PW305B	No Effect
24573	NA	1	PW305A	No Effect
24574	NA	Orig.	PW305A	No Effect
24578	NA	1	PW305A	Feb 27/2009
24579	NA	Orig.	PW305A, PW305B	No Effect
24582	NA	1	PW305A, PW305B	No Effect
24583	NA	1	PW305A, PW305B	No Effect
24584	NA	2	PW305A, PW305B	No Effect
24592	NA	1	PW305A	No Effect
24593	NA	Orig.	PW305A, PW305B	No Effect
24595	NA	1	PW305A, PW305B	No Effect
24597	NA	1	PW305A, PW305B	Sep 12/2008
24599	NA	Orig.	PW305A	No Effect
24600	NA	Orig.	PW305A	No Effect
24601	NA	Orig.	PW305A, PW305B	No Effect
24602	NA	Orig.	PW305A, PW305B	No Effect
24603	NA	Orig.	PW305A	No Effect
24604	NA	1	PW305A	No Effect
24605	NA	Orig.	PW305A, PW305B	No Effect
24606	NA	Orig.	PW305A, PW305B	No Effect
24607	NA	Orig.	PW305A, PW305B	No Effect
24608	NA	Orig.	PW305A	Feb 27/2009

LIST OF CHAPTER/SECTION/SUBJECTS

CHAPTER/SECTION/SUBJECT	TITLE
INTRODUCTION	Introduction
AIRWORTHINESS LIMITATIONS	Airworthiness Limitations
05-00	Time Limits
05-00-00	Time Limits
05-10	Operating Limits
05-10-00	Operating Limits and Leading Particulars
05-20	Scheduled Maintenance Checks
05-20-00	Scheduled Maintenance Checks
05-50	Unscheduled Maintenance Checks
05-50-00	Unscheduled Maintenance Checks
70-00	Standard Practices
70-00-00	Standard Practices
71-00	Power Plant
71-00-00	Power Plant
72-00	Engine
72-00-00	Engine, General
72-30	Compressor
72-30-00	Compressor Section
72-30-01	LP Compressor
72-30-02	Gas Generator Case (Heavy Maintenance Only)
72-40	Combustion Section
72-40-00	Combustion Section
72-40-01	Combustor
72-50	Turbine Section
72-50-00	Turbine Section
72-50-01	HP Turbines

CHAPTER/SECTION/SUBJECT	TITLE
72-50-02	LP Turbine Module
72-50-03	Exhaust Case
72-60	Accessory Gearbox
72-60-00	Accessory Gearbox
72-60-01	Accessory Gearbox
72-70	Bypass Section
72-70-00	Bypass Ducts
72-70-01	Bypass Ducts
73-00	Engine Fuel and Control
73-00-00	Fuel and Control
73-10	Fuel Distribution
73-10-01	Fuel Tubes
73-10-02	Fuel Pump
73-10-03	Fuel Filter and Fuel Waste Ejector
73-10-04	Fuel Manifold
73-10-05	Fuel Shut-off and Drain System
73-20	Fuel Controlling
73-20-01	Hydromechanical Metering Unit (HMU)
73-20-02	Electronic Engine Control (EEC)
73-20-03	Wiring Harnesses
74-00	Ignition
74-00-00	Ignition System
74-10	Electrical Power Supply
74-10-01	Ignition System and Related Parts
75-00	Air
75-00-00	Air System
75-10	Engine Anti-icing

CHAPTER/SECTION/SUBJECT	TITLE
75-10-01	Anti-icing Valve
75-10-02	Cabin Bleed Air
75-30	Compressor Control
75-30-01	Compressor Bleed Valves
75-30-02	BOV Solenoid Valve
75-30-03	P3 Tubes
75-30-04	VIGV Actuator
77-00	Engine Indicating
77-00-00	Engine Indicating
77-10	Power
77-10-01	Speed Sensors
77-20	Temperature
77-20-01	T4.5 Thermocouples
77-20-02	P1/T1 Sensors
79-00	Oil
79-00-00	Oil System
79-20	Distribution
79-20-01	Oil Filter and Housing
79-20-02	Fuel/Oil Heat Exchanger
79-20-03	Scavenge Oil Tubes
79-20-04	Pressure Oil Tubes
79-20-05	Oil Pump Assembly
79-30	Indicating
79-30-01	Chip Detector
79-30-02	Oil Pressure Measuring System
79-30-03	Oil Filler Neck/Sight Glass

TABLE OF CONTENTS

SUBJECT	PAGE
INTRODUCTION	
1. General	1
2. Customer Service	1
3. Maintenance Concept	2
A. Line Maintenance	2
B. Heavy Maintenance	2
4. How to Use this Manual	2
A. Chapter/Section/Subject Numbering	2
B. Chapter 72	3
C. Other Chapters	3
D. Page Numbering	3
E. Line Replaceable Units (LRUs) and Check/Servicing Procedures	3
F. Hot Section Inspection (HSI)	5
5. Supplementary Publications	5
6. Service Bulletins	5
7. Special Tool Service Bulletins	5
8. Suppliers and Supplier Services	5
9. Safety	5
10. Directional References	6
11. Build Specifications (BS)	6
12. Abbreviations	6
SPECIAL TOOLS/FIXTURES AND EQUIPMENT	
1. General	1
2. Special Tools	1
3. Fixtures and Equipment	33

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT PAGE

CONSUMABLE MATERIALS

1. General 1
2. Consumable Materials 1
   - A. Consumable Material 1
   - B. Trade Names 1
   - C. Specification Numbers 1
   - D. Material Safety Data Sheets (MSDS) 1
   - E. Consumable Materials 1
   - F. Supplier Codes and Addresses 11

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Nov 28/2008
	2	Nov 28/2008
Contents	1	Nov 28/2008
	2	Nov 28/2008
Introduction	1	Nov 28/2008
	2	Nov 28/2008
	3	Nov 28/2008
	4	Nov 28/2008
	5	Nov 28/2008
	6	Nov 28/2008
	7	Nov 28/2008
	8	Nov 28/2008
	9	Nov 28/2008
	10 blank	Nov 28/2008
Special Tools Fixtures and Equipment	1	Sep 12/2008
	2	Sep 12/2008
	3	Sep 12/2008
	4	Sep 12/2008
	5	Sep 12/2008
	6	Sep 12/2008
	7	Sep 12/2008
	8	Sep 12/2008
	9	Sep 12/2008
	10	Sep 12/2008
	11	Sep 12/2008
	12	Sep 12/2008
	13	Sep 12/2008
	14	Sep 12/2008
	15	Sep 12/2008
	16	Sep 12/2008
	17	Sep 12/2008
	18	Sep 12/2008
	19	Sep 12/2008
	20	Sep 12/2008
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	23	Sep 12/2008
	24	Sep 12/2008
	25	Sep 12/2008
	26	Sep 12/2008
	27	Sep 12/2008
	28	Sep 12/2008
	29	Sep 12/2008
	30	Sep 12/2008
	31	Sep 12/2008
	32	Sep 12/2008
	33	Sep 12/2008
	34	Sep 12/2008
	35	Sep 12/2008
	36 blank	Sep 12/2008
Consumable Materials	1	Jul 16/2004
	2	Jul 16/2004
	3	Jul 16/2004
	4	Jul 16/2004
	5	Jul 16/2004
	6	Jul 16/2004
	7	Jul 16/2004
	8	Jul 16/2004
	9	Jul 16/2004
	10	Jul 16/2004
	11	Jul 16/2004
	12	Jul 16/2004
	13	Jul 16/2004
	14	Jul 16/2004
	15	Jul 16/2004
	16	Jul 16/2004
	17	Jul 16/2004
	18	Jul 16/2004
	19	Jul 16/2004
	20	Jul 16/2004
	21	Jul 16/2004
	22	Jul 16/2004
	23	Jul 16/2004
	24	Jul 16/2004
	25	Jul 16/2004
	26	Jul 16/2004
	27	Jul 16/2004
	28	Jul 16/2004

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LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
	29	Jul 16/2004
	30	Jul 16/2004
	31	Jul 16/2004
	32	Jul 16/2004

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INTRODUCTION

1. General

A. This maintenance manual contains the recommended procedures for maintaining PW305 engines manufactured by Pratt & Whitney Canada. Personnel involved with engine maintenance should acquaint themselves with the contents of the following introductory paragraphs for full comprehension of the information contained in this manual.

B. Procedures in this manual may be accomplished with the engine installed or removed from the airframe. This manual will be revised as necessary to incorporate any changes as they arise and also incorporate latest approved procedures and data. This manual is not customized to any particular airframe installation. Configurational variations that may arise as a result of installation or peculiar requirement will be dealt with in the text as they occur.

C. Any discrepancies, problems or suggestions regarding this publication should be forwarded in writing, using the Pratt & Whitney Canada Customer Feedback Sheet (RSVP), and directed to:

Pratt & Whitney Canada
1000 Marie-Victorin Blvd.
Longueuil, Quebec
Canada J4G 1A1

Attention: Manager Publications Dept. (05MS1)
FAX: 450-468-7688

Website: www.pwc.ca

E-mail: publications@pwc.ca

D. Customer Feedback Sheets are enclosed with new manuals and each subsequent revision. Additional forms may be obtained by contacting: The Supervisor, Publications Customer Services, at the above address. An on-line RSVP form is also available via the P&WC website above.

2. Customer Service

Customer Service representatives maintain contact with operators and service activities and are available for investigation of any specific difficulty or problem. Requests for assistance should be directed to:

Pratt & Whitney Canada Corp.
1000 Marie-Victorin Blvd.
Longueuil, Quebec
Canada J4G 1A1

Attention: Manager - Customer Solutions Large Turbofan Engines

Requests for AOG support should also be directed to:

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Pratt & Whitney Canada Corp.
1000 Marie-Victorin Blvd.
Longueuil, Quebec
Canada J4G 1A1

Attention: Customer First Center (CFirst)

REF: CFirst (24-hour service)

Toll Free - USA and Canada: 1-800-268-8000

Toll Free - International: (International Access Code) + 8000-268-8000

Other: 1-450-647-8000

FAX: 1-450-647-2888

E-mail: CFirst@pwc.ca

3. Maintenance Concept

The maintenance functions for the PW305 engines detailed in this manual fall into two categories: Line Maintenance and Heavy Maintenance. Repairs beyond the levels detailed in this manual are not recommended and should be accomplished by an approved overhaul facility.

A. Line Maintenance

The scope of line maintenance consists essentially of the removal and installation of external components and engine accessories. All procedures are to be considered line maintenance in the absence of the words "(Heavy Maintenance Only)" appearing with procedure title in Maintenance Practices.

B. Heavy Maintenance

Heavy maintenance details Hot Section Refurbishment, repair and removals considered beyond the normal capabilities of the average line maintenance shop. The scope includes the removal and installation of engine internal components and limited repair to the hot section area. Instructions are given with the understanding that Standard Practices, Chapter 70, has been read, entirely understood and will be followed.

4. How to Use this Manual

A. Chapter/Section/Subject Numbering

(1) Subject matter in this manual is separated into specific Chapters, Sections and Subjects in accordance with ATA Specification No. 100. Each Chapter is divided into sections and each section is divided into subjects. These three elements are shown in large bold numbers at the lower right hand corner of each page, where applicable. Chapters are separated by yellow tab dividers and specific Section/Subjects are separated by green tab dividers.

(2) Chapters contained in this are as follows:

Airworthiness Limitations	Life Limited Parts
5	Time Limits/Maintenance Checks

70	Standard Practices
71	Power Plant
72	Engine
73	Fuel and Control Systems
74	Ignition System
75	Air System
77	Engine Indicating System
79	Oil System

B. Chapter 72

(1) Chapter 72 is divided into Sections as follows:

72-00	Engine General
72-30	Compressor
72-40	Combustor
72-50	Turbines
72-60	Accessory Gearbox
72-70	Bypass Ducts

C. Other Chapters

(1) Chapter/Section breakdown for the other Chapters is extensive and is shown in the Table of Contents for each Chapter.

D. Page Numbering

(1) Blocks of page numbers are allocated for different subject topics as follows:

Introduction	Pages 1 through 99
Description and Operation	Pages 1 through 99
Fault Isolation	Pages 101 through 199
Maintenance Practices	Pages 201 through 299
Servicing	Pages 301 through 399
Removal/Installation	Pages 401 through 499
Adjustment/Test	Pages 501 through 599
Inspection/Check	Pages 601 through 699
Cleaning/Painting	Pages 701 through 799
Approved Repairs	Pages 801 through 899

(2) If a maintenance practice is extensive, the procedure is covered by the more specific page block such as Removal/Installation or Inspection.

E. Line Replaceable Units (LRUs) and Check/Servicing Procedures (Ref. Table 1)

(1) LRUs are any unit that can be readily changed on an aircraft during line maintenance operations.

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(2) Check/Servicing procedures include borescope inspection, oil and ignition servicing.

TABLE 1, LRU Index

LRU	CH/SE/SU
AGB and Oil Seals	72-60-01
AGB Breather Orifice (Square Drive Adapter)	72-60-01
Anti-ice Solenoid Valve	75-10-01
Bypass Ducts	72-70-01
Chip Detector	72-00-00
Cold Start Valve	72-60-01
Compressor Bleed Valves	75-30-01
BOV Solenoid	75-30-02
EEC	73-20-02
Fan	72-30-01
Fuel Waste Ejector	73-10-03
Fuel Manifold and Nozzles	73-10-04
Fuel Shut-off Valve	73-10-05
Fuel Dump Valve	73-10-05
Fuel Filter	73-10-03
Fuel Pressure Tubes	73-10-01
Fuel Pump	73-10-02
Fuel/Oil Heat Exchanger	79-20-02
HMU	73-20-01
Igniters	74-10-01
Ignition Exciters	74-10-01
Ignition Cables	74-10-01
N1 and N2 Speed Sensors	77-10-01
N1/T4.5 Terminal Box	77-20-01
Oil Pressure Adjusting Valve	79-20-01
Oil Pressure Tubes	79-20-04
Oil Scavenge Tubes	79-20-03
Oil Filter	79-20-01
Oil Pressure Measuring System	79-30-02
Oil Pump	79-20-05
Over-pressure "Pop-up" Indicator	79-30-03
P1/T1 Sensors	77-20-02
P3 Air Tubes	75-30-03
Rotary Stator Vane Actuator	75-30-04

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TABLE 1, LRU Index (Cont'd)

LRU	CH/SE/SU
T4.5 Thermocouple Wiring Hamess	77-20-01
Wiring Harnesses	73-20-03
CHECK/SERVICING PROCE-DURES	
AGB Scavenge Pump Strainer	72-00-00
Borescope HPC4 and HPT1	72-00-00
Ignition Check	74-10-01
Oil Servicing	72-00-00

F. Hot Section Inspection (HSI)

(1) HSI requires removal of the Exhaust Case, LP Turbine, HP Turbine and the Combustor. Refer to Chapter 72-00-00, INSPECTION for an outline of the HSI procedure.

5. Supplementary Publications

Personnel concerned with the maintenance of PW305 series engines should familiarize themselves with the content of the Illustrated Parts Catalog, P&WC Manual P/N 30B1403, which lists and describes the saleable parts of the engine and illustrates their inter-relationship.

6. Service Bulletins

Service bulletins will be issued as required to provide information or instructions for modifying engines or parts to the latest configuration.

7. Special Tool Service Bulletins

Special Tool Service Bulletins will be issued as required to provide instructions for modifying special tools to a later configuration.

8. Suppliers and Supplier Services

The names of any companies provided in this publication as a possible source for required services or supplies are furnished for information purposes only. Pratt & Whitney Canada does not endorse the work performed or supplies procured from these companies. Furthermore, Pratt & Whitney Canada does not accept responsibility, to any degree, for the selection of such companies for such work performed or supplies procured.

9. Safety

This manual describes processes that may require the use of chemicals, solvents, paints or other commercially available materials.

Before using any of the consumable materials be aware of all handling, storage and disposal precautions recommended by the manufacturer or supplier. Failure to comply with manufacturer's or supplier's recommendations may result in injury or disease.

P&WC Proprietary Information. Subject to the restrictions on the title page.

Material Safety Data Sheets (MSDS) containing information about Trade Name, Safety Hazards, Health Hazards, Reactivity, Spill or Leak Procedures, Special Protection Information, Special Precautions and Transportation and Labelling are available from the manufacturer. Read prior to using consumable materials.

10. Directional References

The terms right or left, clockwise or counterclockwise, upper or lower, and similar directional referenced, will apply to the engine as viewed from the rear with the engine in a horizontal position.

11. Build Specifications (BS)

The following Build Specifications (BS) are applicable throughout this manual unless otherwise specified:

BS742 (PW305)
BS745 (PW305)
BS772 (PW305A)
BS811 (PW305A)
BS822 (PW305B)
BS1162 (PW305B)
BS1188 (PW305A)

12. Abbreviations

The following is a list of abbreviations used throughout this manual:

AGB	Accessory Gearbox
A/D	Analog to Digital Converter
AC	Aircraft
A/I	Anti Icing
ADC	Air Data Computer
AMM	Aircraft Maintenance Manual
AMS	Aerospace Material Specification
AOG	Aircraft on Ground
APR	Automatic Power Recovery
ASSY	Assembly
ARINC	Aeronautical Radio Incorporated
ATA	Air Transportation Association
ATTCS	Automatic Take Off Thrust Control System
BIT	Binary Digit
BITE	Built-in Test Equipment
BOV	Bleed-off Valve
°C	Degrees Celsius
cc	Cubic Centimeters

P&WC Proprietary Information. Subject to the restrictions on the title page.

CCW	Counterclockwise
CG	Center of Gravity
CL	Class
CPU	Central Processing Unit
CW	Clockwise
D/A	Digital to Analogue Converter
Dia.	Diameter
Dim.	Dimension
ECS	Environment Control System
EDS	Engine Diagnostic System
EDU	Engine Diagnostic Unit
EEC	Electronic Engine Control
EEROM	Electrically Erasable Read Only Memory
EGT	Exhaust Gas Temperature
F & C	Fits and Clearances
°F	Degrees Fahrenheit
FADEC	Full Authority Digital Electronic Control
FCU	Fuel Control Unit
Fig.	Figure
FI	Flight Idle
FIR	Full Indicator Reading
FOD	Foreign Object Damage
FSOV	Fuel Shut-off Valve
Fwd.	Forward
GI	Ground Idle
GND	Ground
HP	High Pressure
hr.	Hour
HSI	Hot Section Inspection
HSR	Hot Section Refurbishment
H/W	Hardware
ID	Inside Diameter
IGV	Inlet Guide Vane
in.	Inch
IPC	Illustrated Parts Catalog
kg.	Kilogram
kPa	Kilopascals
lb.	Pound
lb.in.	Pound-inch
LE	Leading Edge
LH	Left Hand
LP	Low Pressure

P&WC Proprietary Information. Subject to the restrictions on the title page.

LRU	Line Replaceable Unit
LVDT	Linear Variable Differential Transformer
Max.	Maximum
MCR	Maximum Cruise
MCT	Maximum Continuous
MFD	Multi Function Display
Min.	Minimum
mm	Millimeter
MOP	Main Oil Pressure
MOT	Main Oil Temperature
MS	Military Standard
msec.	Millisecond
N1	Low-pressure Rotor Speed
N1R	Low-pressure Rotor Remote Speed
N2	High-pressure Rotor Speed
N2R	High-pressure Rotor Remote Speed
N	Newton
N.m	Newton-meter
OAT	Outside Air Temperature
O/C	Open Circuit
OD	Outside Diameter
O/H	Overhaul
O/S	Overspeed
oz.	Ounce
P1	Fan Inlet Pressure
P2.5	Compressor Interstage (3rd & 4th) Discharge Pressure
P2.8	Impeller Inlet Pressure
P3	Compressor Discharge Pressure
Pamb or PAMB	Ambient Engine Inlet Pressure
PAV	Pressure Adjusting Valve
P/N	Part Number
PMA	Permanent Magnet Alternator
PRES	Pressure
psi	Pounds per Square Inch
psia	Pounds per Square Inch (absolute)
psid	Pounds per Square Inch (differential)
psig	Pounds per Square Inch (gage)
Pt or PT	Engine Inlet Total Pressure
PWC	Pratt and Whitney Canada
RAM	Random Access Memory
Ref.	Reference

P&WC Proprietary Information. Subject to the restrictions on the title page.

Repl.	Replacement
RES.	Resistance
RH	Right Hand
ROM	Read Only Memory
rpm	Revolutions per Minute
RVDT	Rotary Variable Differential Transformer
SB	Service Bulletin
S/C	Short Circuit
sec.	Second
SG	Specific Gravity
SOL.	Solenoid
S/W	Software
T4.8	Inter-turbine Temperature
tamb	Ambient Temperature
TBA	To Be Advised
TBD	To Be Determined
TBO	Time Between Overhaul
TDC	Top Dead Center
Temp	Temperature
TLA	Throttle Lever Angle
T/R	Thrust Reverser
Toil	Oil Temperature
TTO	Engine Inlet Total Temperature
UART	Universal Asynchronous Receiver and Transmitter
UOS	Unless Otherwise Specified
U/S	Unserviceable
V	Volt
VIGV	Variable Inlet Guide Vane
1VS	First-stage Variable Stator
W	Watt
W/D	Watch Dog
WF or Wf	Fuel Flow
WOW	Weight on Wheels

P&WC Proprietary Information. Subject to the restrictions on the title page.

SPECIAL TOOLS/FIXTURES AND EQUIPMENT

1. General

This section gives data about the special tools and the fixtures and equipment listed in this manual.

2. Special Tools

Special tools required to maintain the engine are listed in Table 1.

Depending on the geographic location of the operator, requests for the purchase of handling tools should be addressed as follows:

Pratt & Whitney Canada - Tooling Solutions (Cage 00198)
Plant 2
333 rue d'Auvergne
Longeuil, QC
Canada J4H 3Y3

TEL: Toll free: 1-800-311-5512 (Canada, USA & International)
Regular and 24-hour service number: 1-450-442-5400
Website: www.pwctoolingsolutions.com
Email: tooling.solutions@pwc.ca
FAX: 450-647-9470

Pratt & Whitney Tool Support Services (Cage 77445)
411 Silver Lane, Mail Stop 129-20
East Hartford, CT 06118
USA

TEL: Toll free (Canada and USA): 1-800-PWA-TOOL (792-8665)
North America: 1-860-610-2675
24-hour service number: 1-800/ or 860/-565-0140
FAX: (860) 610-2670

Kell-Strom Tool Co.
214 Church Street
Wethersfield, CT 06109
USA

Groupe Rasakti Inc. (Cage 3AD21)
3000 Power Street
Drummondville, QC
Canada J2C 6H9

TEL: Regular and 24-hour service number: 819-474-3366
Toll free (Canada and USA): 1-888-RASAKTI (727-2584)
Website: http://www.rasakti.com
FAX: 819-474-3055

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE 1, Special Tools

Part No.	Name	CH/SE/SU	Maintenance Level		
			Line	Heavy	HSI
PWC30128	Puller	72-30-01	X	X	
		79-20-01	X	X	
PWC30304	Rivet Set	72-50-01	X	X	
PWC31062	Drift	72-60-01	X	X	
PWC31382-02	Extractor	72-60-01	X	X	
PWC31771	Shanknut Spreader	70-00-00	X	X	X
PWC32396-100	Jackscrew	72-30-01		X	
PWC32505	Adapter	72-30-01		X	X
		72-50-01		X	X
		72-50-02		X	X
PWC32506	Cylinder	72-30-01		X	X
		72-50-01		X	X
		72-50-02		X	X
PWC32550	Adapter	72-30-01		X	X
		72-50-01		X	X
		72-50-02		X	X
PWC32677-300	Engine Wash Rig	71-00-00	X		
PWC34520	DELETED				
PWC37082	DELETED				
PWC37088-002	Drift	72-60-01		X	
PWC37711	DELETED				
PWC37728	Puller	72-00-00		X	
PWC37807	Pump	72-30-01		X	X
		72-50-01		X	X
		72-50-02		X	X
PWC41050	Wrench	72-30-01		X	
		72-50-01		X	
		72-50-02		X	
PWC41150	Adapter	72-30-01		X	X
		72-50-01		X	X
		72-50-02		X	X

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE 1, Special Tools (Cont'd)

Part No.	Name	CH/SE/SU	Maintenance Level		
			Line	Heavy	HSI
PWC43012	DELETED				
PWC43013	Base	72-50-02		X	X
PWC43017	Fixture	72-30-01		X	
PWC43021	DELETED				
PWC43022	Sling	72-40-01		X	X
PWC43026	Sling	72-50-03		X	X
PWC43052	DELETED				
PWC43053	Fixture	72-50-01		X	X
PWC43057	Pad	72-50-01		X	X
PWC43058	DELETED				
PWC43059	DELETED				
PWC43060	DELETED				
PWC43063	Fixture	72-50-01		X	X
PWC43064	Adapter	72-50-01		X	X
PWC43071	Puller	72-50-01		X	X
PWC43072	Drift	72-50-01		X	X
PWC43125	Puller	72-60-01	X	X	
PWC43131	Socket	79-20-01	X	X	
PWC43160	DELETED				
PWC43161	DELETED				
PWC43172	Puller	71-00-00	X	X	
		72-00-00	X	X	
		79-20-01	X	X	
PWC43173	Puller	79-20-01	X	X	
PWC43176	Puller	72-60-01	X	X	
PWC43177	Puller	72-60-01	X	X	
PWC43184	Extractor	72-60-01	X	X	
PWC43205	Puller	72-50-01		X	X
PWC43206	Drift	72-50-01		X	X
PWC43209	Puller	72-40-01		X	X
		72-50-01		X	X

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE 1, Special Tools (Cont'd)

Part No.	Name	CH/SE/SU	Maintenance Level		
			Line	Heavy	HSI
PWC43213	Puller	72-50-01		X	X
PWC43215	Base	72-50-01		X	X
PWC43238	Riveter	71-00-00		X	
		72-30-01		X	
PWC43239	Set	71-00-00		X	
		72-30-01		X	
PWC43240	Set	71-00-00		X	
		72-30-01		X	
PWC43248	Pad	72-30-01		X	
PWC43250	Protector	72-30-01		X	
		72-50-01		X	X
		72-50-02		X	X
PWC43251	DELETED				
PWC43260	Socket	72-30-01		X	
PWC43261	Socket	72-30-01		X	
PWC43262	Adapter	72-30-01		X	
PWC43263	DELETED				
PWC43264	Puller	72-30-01		X	X
PWC43265	Socket	72-50-02		X	X
PWC43266	Adapter	72-50-02		X	X
PWC43267	DELETED				
PWC43268	Adapter	72-50-02		X	X
PWC43270	Puller	72-50-02		X	X
PWC43271	Pusher	72-50-02		X	X
PWC43272	Puller	72-50-02		X	X
PWC43273	DELETED				
PWC43274	Pad	72-50-02		X	X
PWC43275	Socket	72-50-01		X	X
PWC43276	Adapter	72-50-01		X	X
PWC43277	Puller	72-50-01		X	X
PWC43278	DELETED				

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE 1, Special Tools (Cont'd)

Part No.	Name	CH/SE/SU	Maintenance Level		
			Line	Heavy	HSI
PWC43279	Puller	72-50-01		X	X
PWC43280	Pusher	72-50-01		X	X
PWC43281	Puller	72-40-01		X	X
		72-50-01		X	X
PWC43282	Drift	72-40-01		X	X
PWC43284	Support	72-50-01		X	X
PWC43285	Base	72-40-01		X	X
PWC43286	Drift	72-50-01		X	X
PWC43311	Pin	75-30-04	X	X	
PWC43312	Pin	75-30-04	X	X	
PWC43357	Puller	72-50-01		X	X
PWC43430	Blanking Cover	71-00-00	X		
PWC43435	Blanking Cover	71-00-00	X		
PWC43442	Bracket	71-00-00	X		
PWC43515	Bar	72-30-01	X	X	X
		72-50-01	X	X	X
PWC43536	DELETED			X	
PWC43537	DELETED				
PWC43540	DELETED				
PWC43541	DELETED				
PWC43553	Socket	72-60-01	X	X	
PWC43572	DELETED				
PWC43580	Puller	72-50-03		X	X
PWC43581	Drift	72-50-03		X	X
PWC43582	Base	72-50-03		X	X
PWC43583	Puller	72-50-03		X	X
PWC43584	Drift	72-50-03		X	X
PWC43661	Riveter	72-50-01		X	
PWC43671	Guide Tube	72-00-00	X	X	
PWC43685	Guide Tube	72-00-00	X	X	
PWC50781	Puller	73-10-01	X	X	

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE 1, Special Tools (Cont'd)

Part No.	Name	CH/SE/SU	Maintenance Level		
			Line	Heavy	HSI
PWC50782	Puller	73-10-01	X	X	
PWC58104	Strap Wrench	77-20-02	X	X	
PWC60014	Pusher	72-50-01		X	X
PWC60071	DELETED				
PWC60079	Puller	72-50-01		X	X
PWC60085	Rivet Set	72-30-01		X	X
PWC60101	Adapter	72-50-01		X	X
PWC60102	Gage	72-50-01		X	X
PWC60105	Wrench	72-50-01		X	X
PWC60122	Grinding Fixture	72-50-01		X	X
PWC60136	Heater Controller	72-50-01		X	X
PWC60139	Puller	72-50-01		X	X
PWC60142	Wrench	72-60-01	X	X	X
		73-10-05	X	X	X
		73-20-01	X	X	X
		73-20-02	X	X	X
		73-20-03	X	X	X
		75-30-04	X	X	X
		77-10-01	X	X	X
		77-20-02	X	X	X
PWC60144	Adapter	72-60-01	X	X	
PWC60149	Lapping Tool	75-30-01	X	X	X
PWC60158	Holding Fixture	75-30-01	X	X	X
PWC60177	Puller	72-50-01		X	X
PWC60224	Pilot	72-60-01	X	X	
PWC60225	Drift	72-60-01	X	X	
PWC60231	DELETED				
PWC60234	Socket	72-50-01		X	X
PWC60242	Crimper	72-50-01		X	X
PWC60243	DELETED				
PWC60248	DELETED				

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE 1, Special Tools (Cont'd)

Part No.	Name	CH/SE/SU	Maintenance Level		
			Line	Heavy	HSI
PWC60295	Extractor	72-60-01	X	X	
PWC60330	DELETED				
PWC60331	Adapter	72-50-01		X	X
PWC60364	Bracket	72-00-00	X	X	
PWC60387	Riveter	72-50-01		X	X
PWC60398	Spacer	72-50-01		X	X
PWC60531	Pad	72-50-01		X	X
PWC60543	Punch	72-50-01		X	X
PWC60614	Punch	71-00-00	X		
PWC60623	Fixture	72-50-01		X	X
PWC60679	Extractor	72-60-01	X	X	
PWC60682	Pusher	72-60-01	X	X	
PWC60683	Pusher	72-60-01	X	X	
PWC60684	Extractor	72-60-01	X	X	
PWC60685	Pusher	72-60-01	X	X	
PWC60708	Nozzle	71-00-00	X		
PWC60709	DELETED				
PWC60710	Clamp	73-10-04		X	X
PWC60711	Adaptor	73-10-04		X	X
PWC60712	Plug	73-10-04		X	X
PWC60714	Puller	75-10-02	X	X	X
PWC60718	Test Kit	73-10-04		X	X
PWC60719	Support	72-50-01		X	X
PWC60731	Fixture	72-50-01		X	X
PWC60738	Fixture	72-50-01		X	X
PWC60758	Spacer	72-00-00	X	X	
		72-30-01	X	X	
PWC60761	Sling	72-50-02		X	X
PWC60764	Drift	72-50-02		X	X
PWC60765	Puller	72-50-02		X	X
PWC60766	Puller	72-50-02		X	X

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE 1, Special Tools (Cont'd)

Part No.	Name	CH/SE/SU	Maintenance Level		
			Line	Heavy	HSI
PWC60774	DELETED				
PWC60786	Pressure Test Kit	73-10-03		X	X
PWC60787	Adapter Plate	73-10-03		X	X
		79-20-01		X	X
PWC60788	Lapping Handle	73-10-03		X	X
		79-20-01		X	X
PWC60791	Gauge	72-50-01		X	X
PWC60801	Fixture	75-30-04	X	X	X
PWC60831	Fixture	79-20-05		X	
PWC60838	Bracket	72-00-00	X	X	
PWC60839	Bracket	72-00-00	X	X	
PWC60877	Guide Tube	72-00-00		X	X
PWC60879	Pressure Test Kit	79-20-01		X	X
PWC60899	Rigging Tool	75-30-04	X	X	X
PWC60916	Heater Assembly	72-50-01		X	X
PWC60930	Adapter	72-50-01		X	X
PWC61014	Stub Shaft Guide	72-50-01		X	X
PWC61148	Locator	72-40-01		X	X
PWC61152	Nozzle, Compressor Wash	71-00-00	X		
PWC61155	Drift	72-60-01	X	X	
PWC61373	Sling	72-00-00	X	X	X
PWC61592	Guide Tube	72-00-00			X
PWC61783	Core-Stator Holder	72-30-01	X	X	
PWC61792	Leak Check Fixture	73-10-04	X	X	
PWC61823	Pad	72-50-01		X	X
PWC62002	Bracket	71-00-00	X		
PWC62003	Riveter	71-00-00	X		
PWC62004	Pusher	71-00-00	X		
PWC62005	Protector	71-00-00	X		
PWC62019	Ring, Retaining Split	71-00-00	X		
PWC62458	Drift	75-30-04	X	X	X

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE 1, Special Tools (Cont'd)

Part No.	Name	CH/SE/SU	Maintenance Level		
			Line	Heavy	HSI
PWC62502	Base	75-30-04	X	X	X
PWC62503	Drift	75-30-04	X	X	X
PWC62504	Base	75-30-04	X	X	X
PWC63068	Heat Shield	72-30-01		X	
PWC63141	Drift	72-50-03		X	X
PWC63224	Base	72-50-03		X	X
PWC63410	Puller	72-50-03		X	X
PWC64241-3	Guide Pin	72-40-01		X	X
PWC66103	Puller	72-00-00	X	X	
PWC66106	Sling	72-00-00	X	X	X
PWC66300	Stand	72-00-00	X	X	X
PWC66581	Wedge	71-00-00	X		
PWC66645	Chisel	71-00-00	X		
PWC90000	Heat Gun	72-30-01		X	
PWC90012	Soft-jawed Pliers	73-20-03	X	X	X

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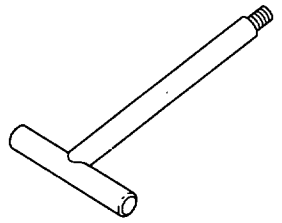
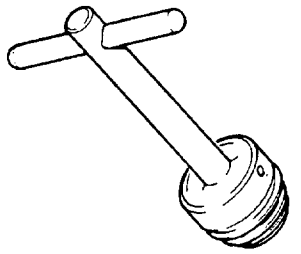
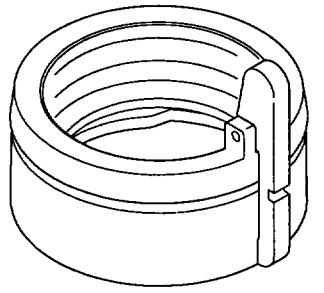
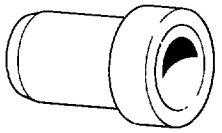
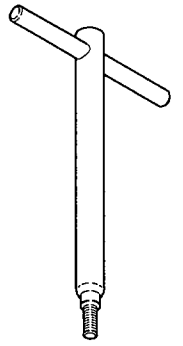
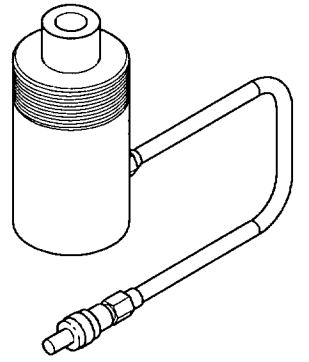
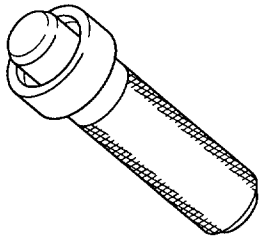
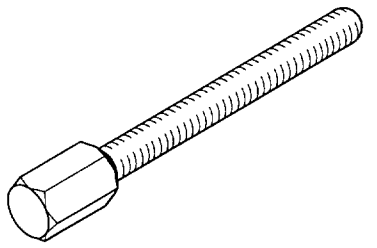
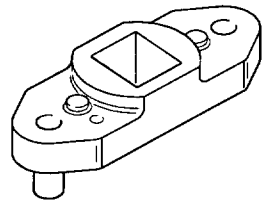
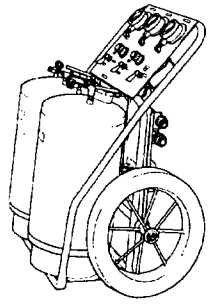
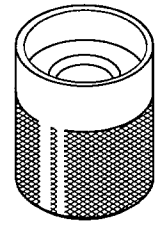
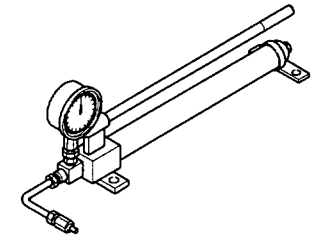
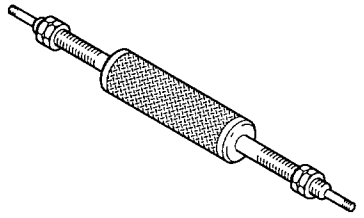
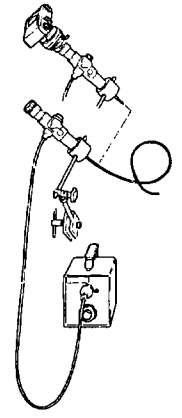
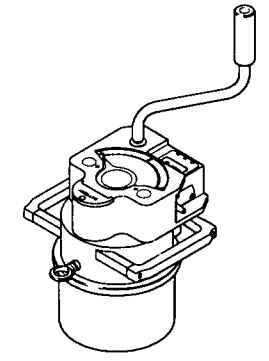
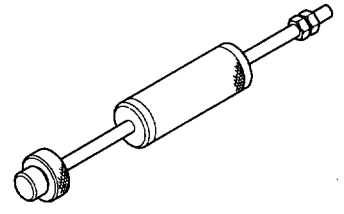
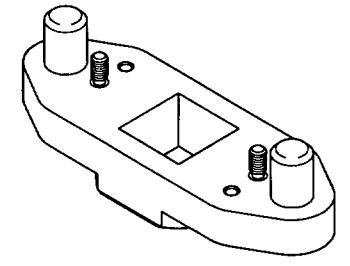
PWC30128 	PWC31382-02 	PWC32505 
PWC30304 	PWC31771 	PWC32506 
PWC31062 	PWC32396-100 	PWC32550 

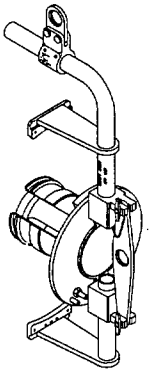
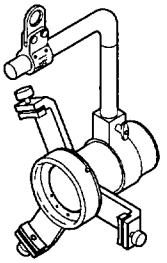
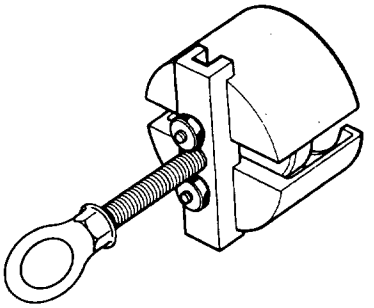
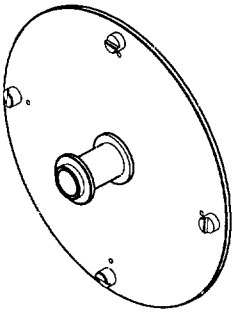
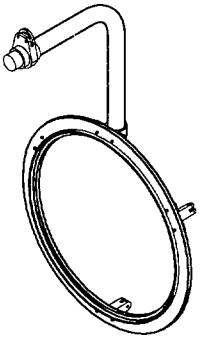
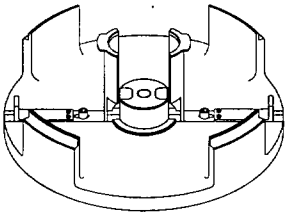
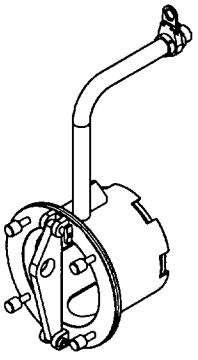
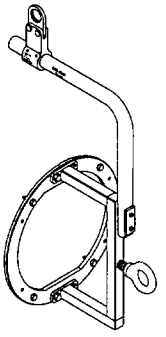
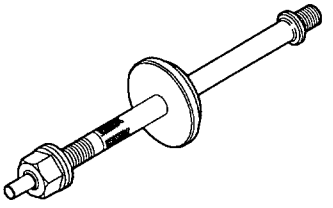
Special Tool Illustrations

P&WC Proprietary Information. Subject to the restrictions on the title page.

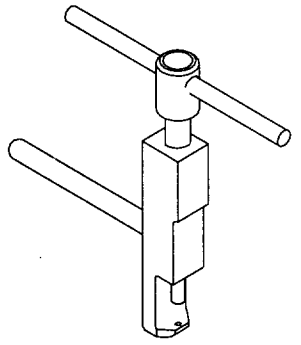
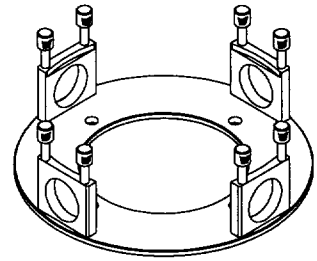
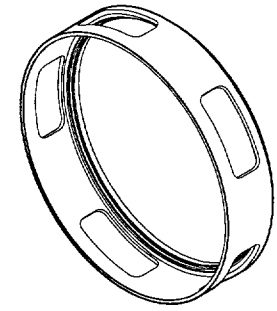
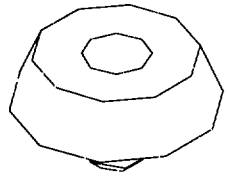
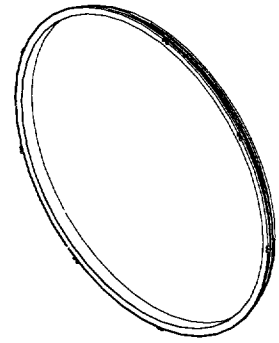
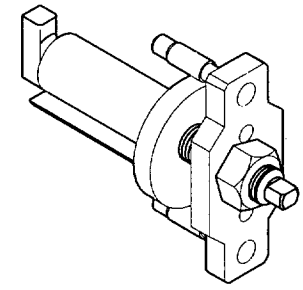
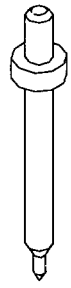
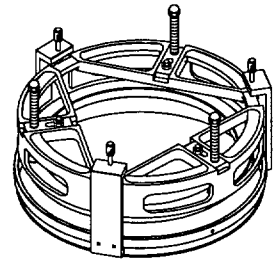
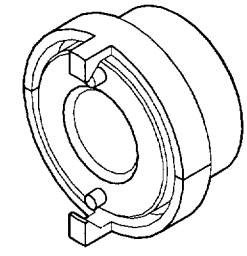
PWC32677-300 	PWC37088-002 	PWC37807 
PWC34520 	PWC37711 	PWC41050 
PWC37082 **TOOL NOT ILLUSTRATED**	PWC37728 	PWC41150 

Special Tool Illustrations

P&WC Proprietary Information. Subject to the restrictions on the title page.

PWC43012 	PWC43021 	PWC43052 
PWC43013 	PWC43022 	PWC43053 
PWC43017 	PWC43026 	PWC43057 

Special Tool Illustrations

PWC43058 	PWC43063 	PWC43072 
PWC43059 	PWC43064 	PWC43125 
PWC43060 	PWC43071 	PWC43131 

Special Tool Illustrations

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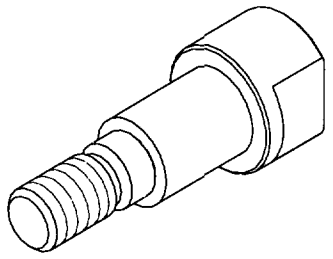
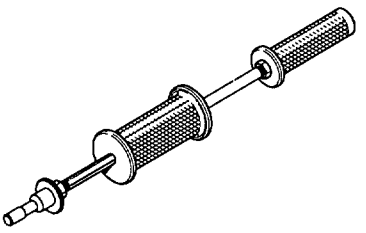
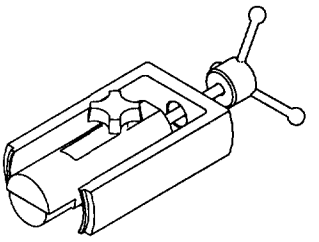
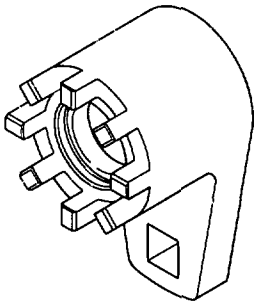
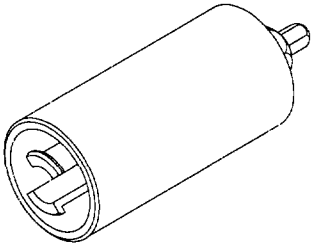
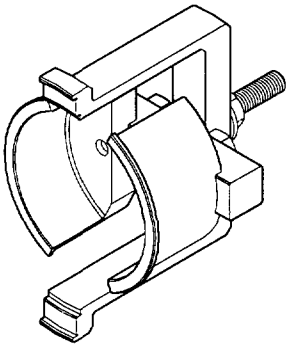
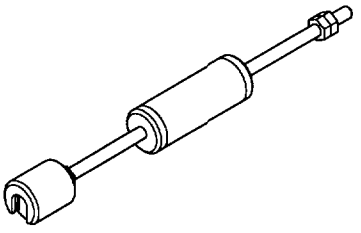
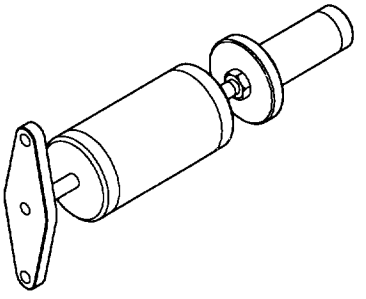
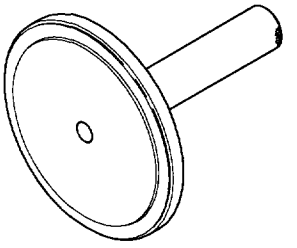
PWC43160 	PWC43173 	PWC43184 
PWC43161 	PWC43176 	PWC43205 
PWC43172 	PWC43177 	PWC43206 

Special Tool Illustrations

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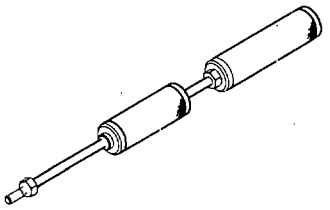
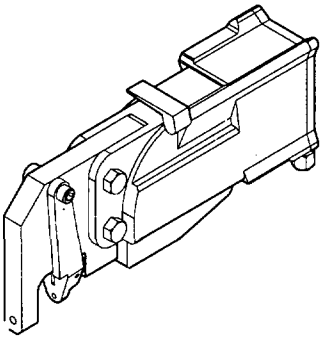
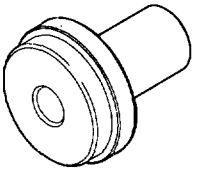
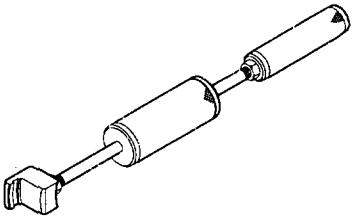
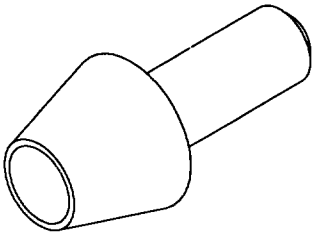
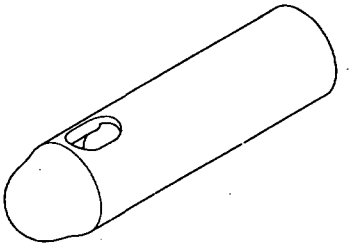
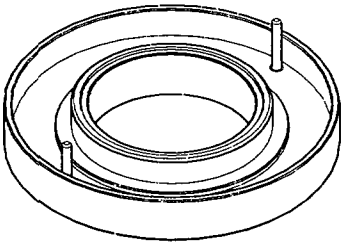
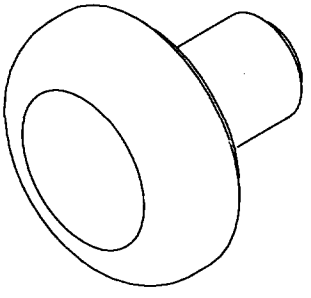
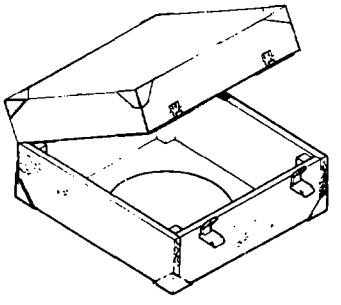
PWC43209 	PWC43238 	PWC43248 
PWC43213 	PWC43239 	PWC43250 
PWC43215 	PWC43240 	PWC43251 

Special Tool Illustrations

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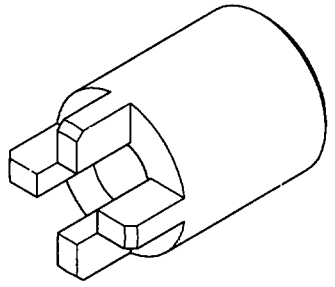
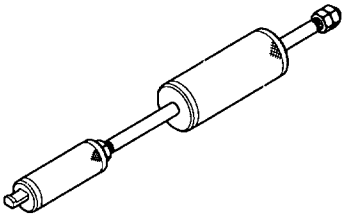
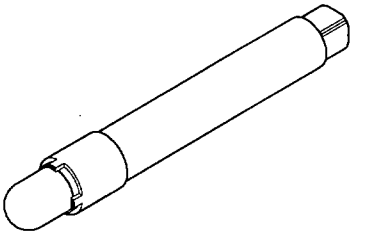
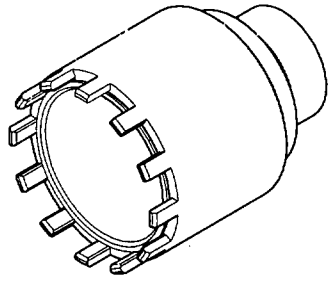
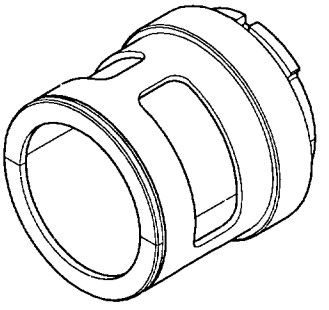
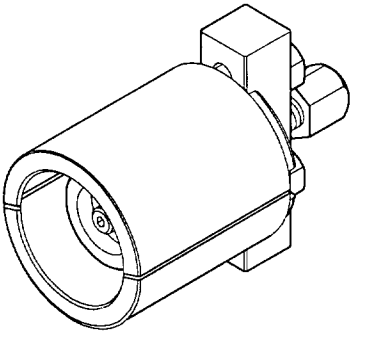
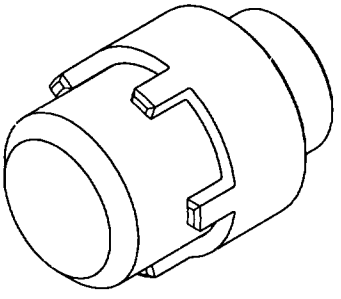
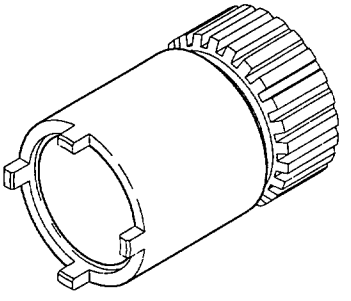
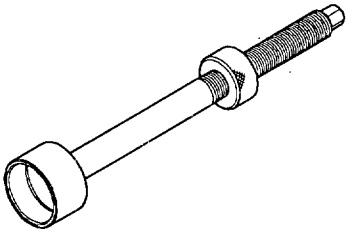
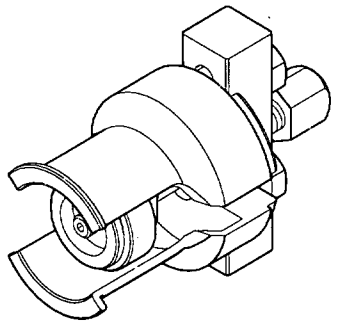
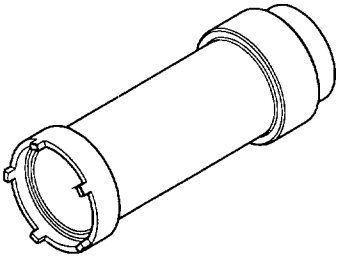
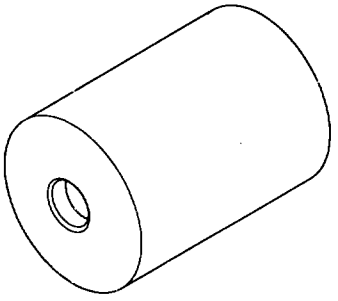
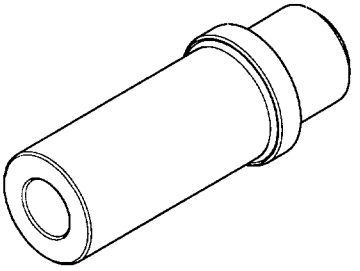
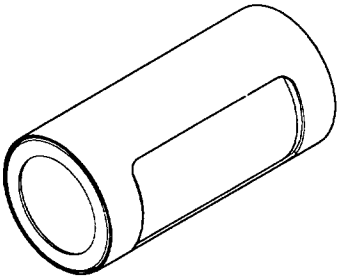
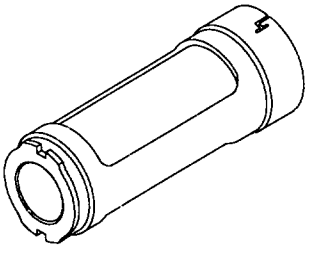
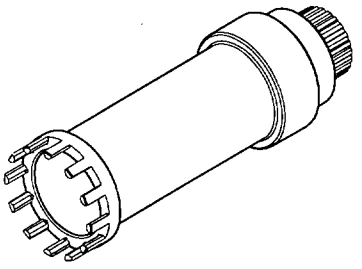
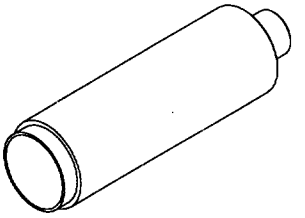
PWC43260 	PWC43263 	PWC43266 
PWC43261 	PWC43264 	PWC43267 
PWC43262 	PWC43265 	PWC43268 

Special Tool Illustrations

P&WC Proprietary Information. Subject to the restrictions on the title page.

PWC43270 	PWC43273 **TOOL NOT ILLUSTRATED**	PWC43276 
PWC43271 	PWC43274 	PWC43277 
PWC43272 	PWC43275 	PWC43278 

Special Tool Illustrations

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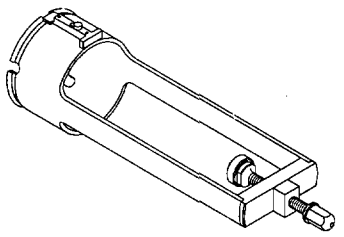
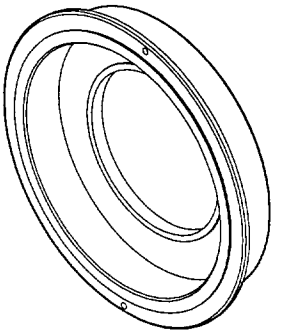
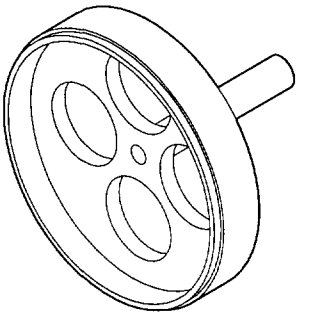
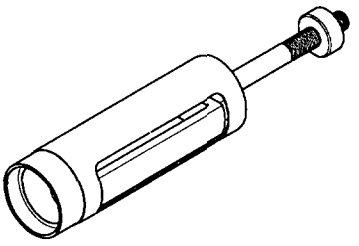
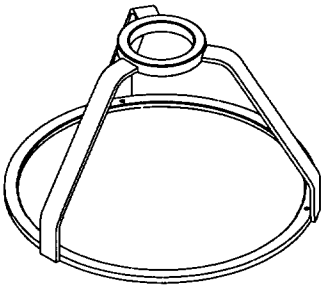
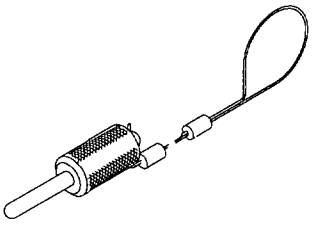
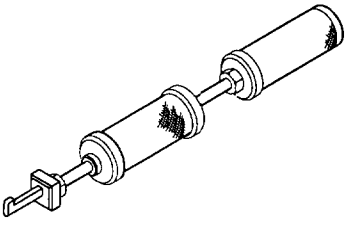
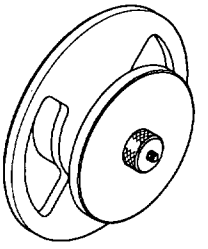
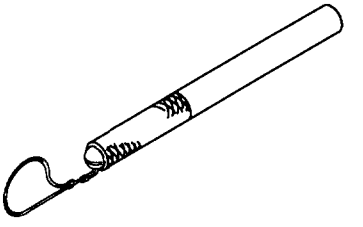
PWC43279 	PWC43282 	PWC43286 
PWC43280 	PWC43284 	PWC43311 
PWC43281 	PWC43285 	PWC43312 

Special Tool Illustrations

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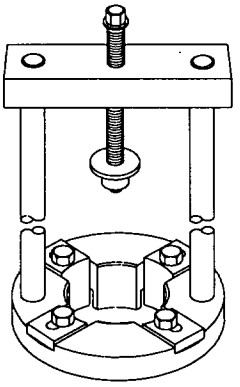
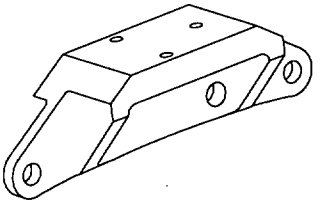
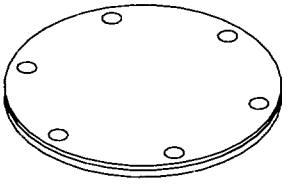
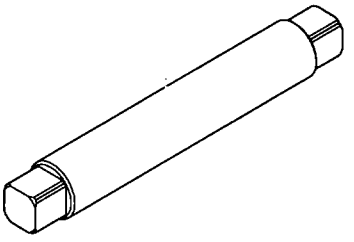
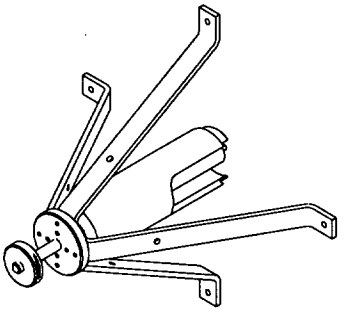
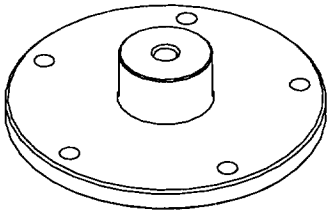
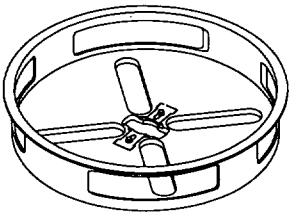
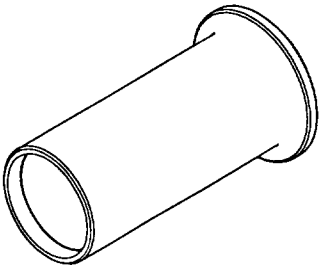
PWC43357 	PWC43442 	PWC43537 **TOOL NOT ILLUSTRATED**
PWC43430 	PWC43515 	PWC43540 
PWC43435 	PWC43536 	PWC43541 

Special Tool Illustrations

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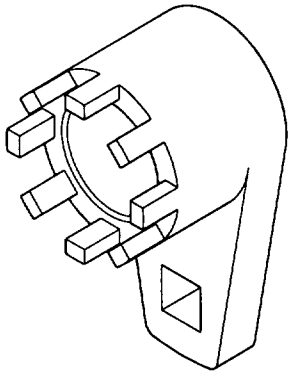
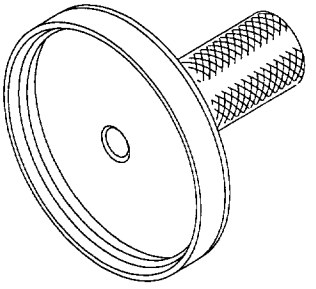
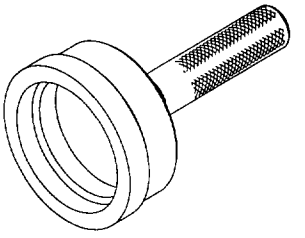
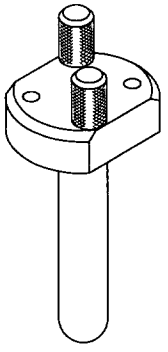
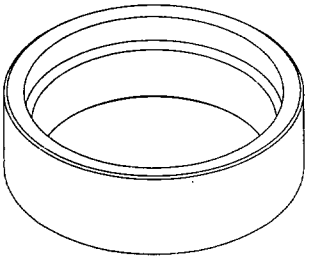
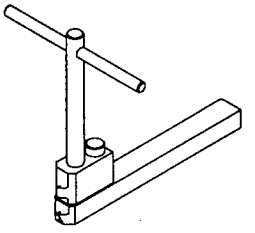
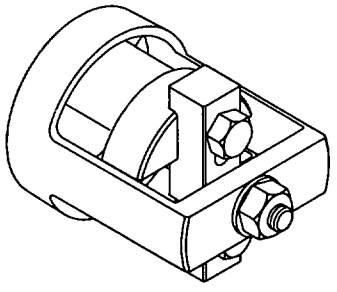
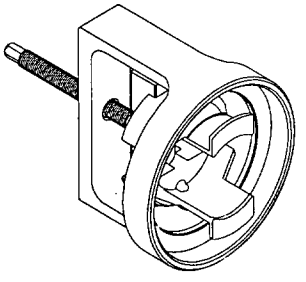
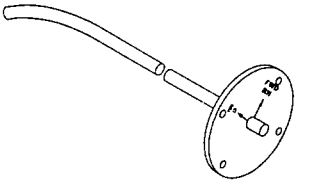
PWC43553 	PWC43581 	PWC43584 
PWC43572 	PWC43582 	PWC43661 
PWC43580 	PWC43583 	PWC43671 

Special Tool Illustrations

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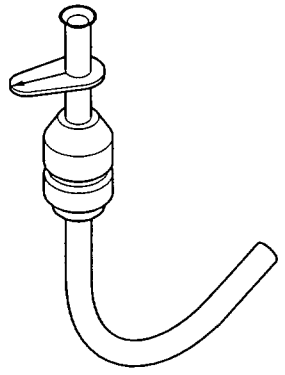
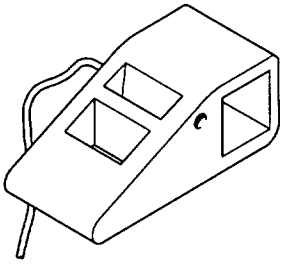
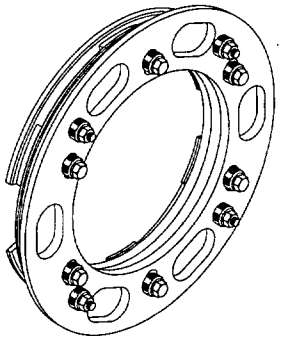
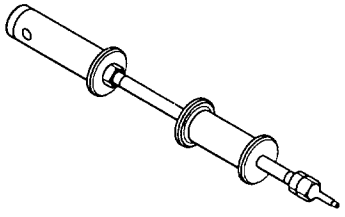
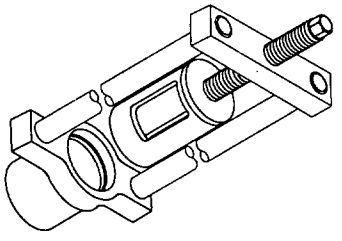
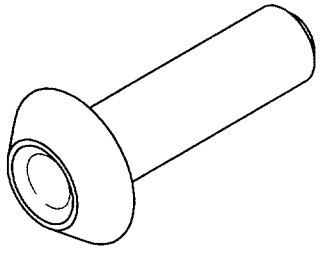
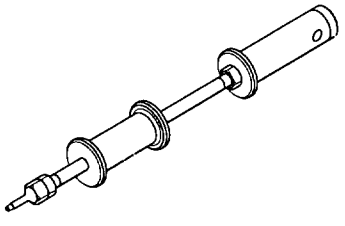
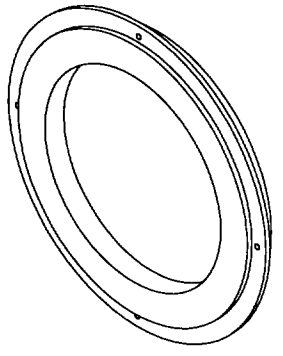
PWC43685 	PWC58104 	PWC60079 
PWC50781 	PWC60014 	PWC60085 
PWC50782 	PWC60071 **TOOL NOT ILLUSTRATED**	PWC60101 

Special Tool Illustrations

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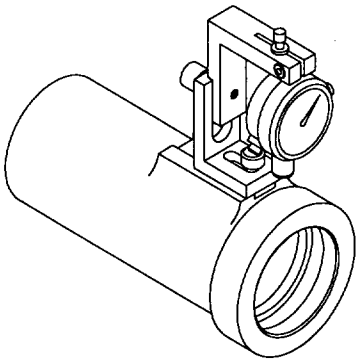
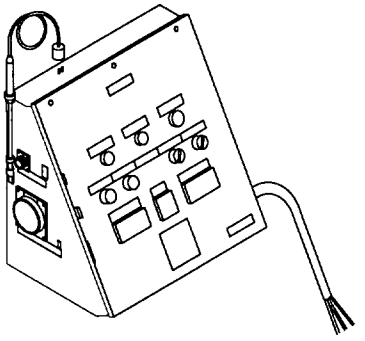
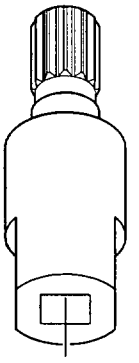
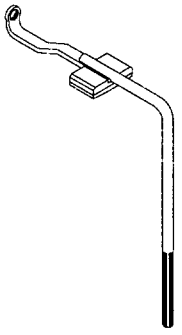
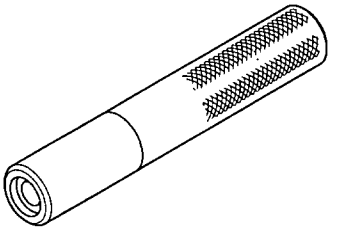
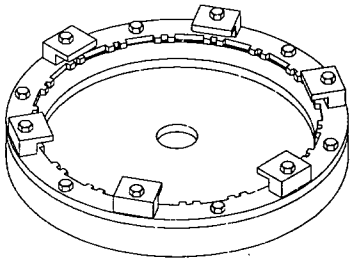
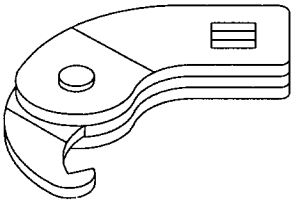
PWC60102 	PWC60136 	PWC60144 
PWC60105 	PWC60139 **TOOL NOT ILLUSTRATED**	PWC60149 
PWC60122 	PWC60142 	PWC60158 **TOOL NOT ILLUSTRATED**

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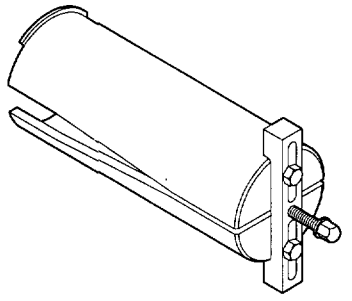
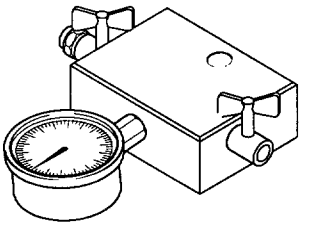
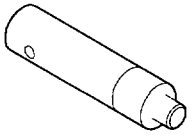
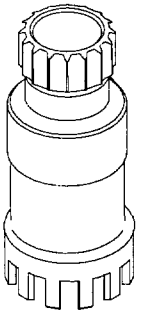
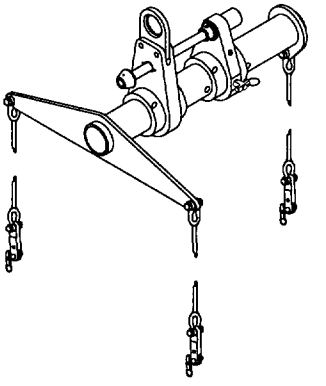
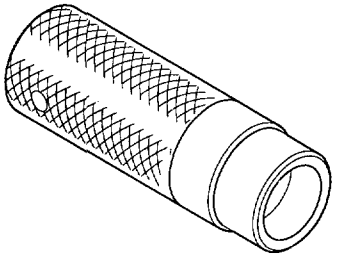
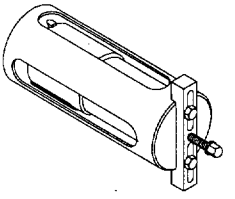
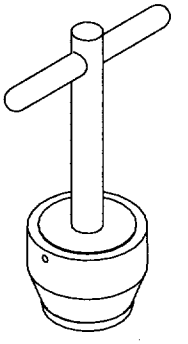
PWC60177 	PWC60231 	PWC60243 **TOOL NOT ILLUSTRATED**
PWC60224 	PWC60234 	PWC60248 
PWC60225 	PWC60242 	PWC60295 

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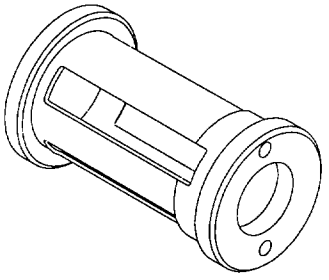
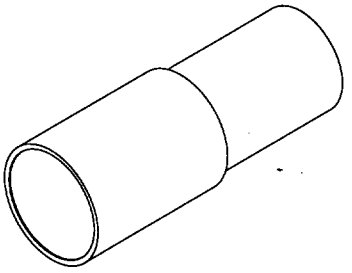
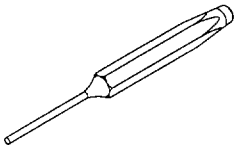
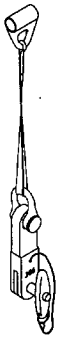
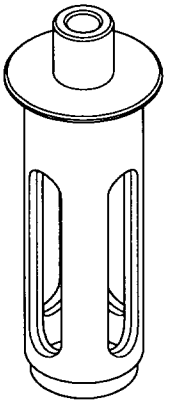
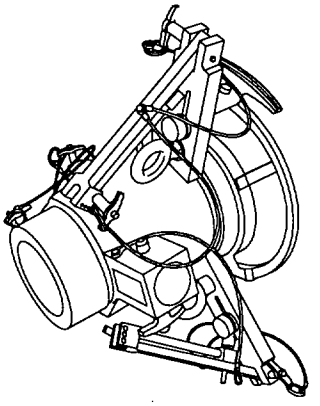
PWC60331 	PWC60398 	PWC60614 
PWC60364 	PWC60531 	PWC60623 

Special Tool Illustrations

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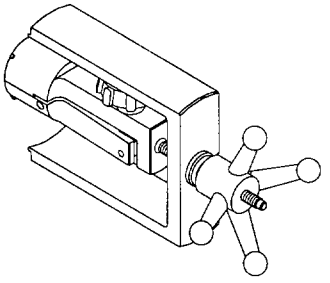
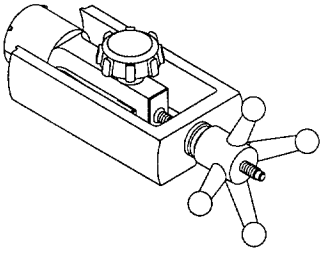
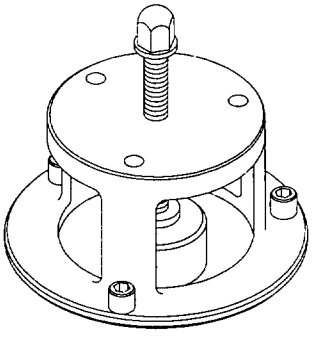
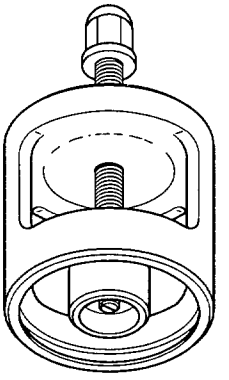
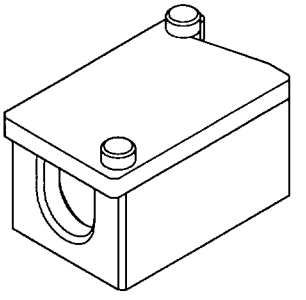
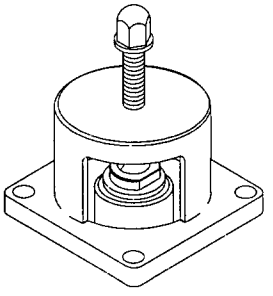
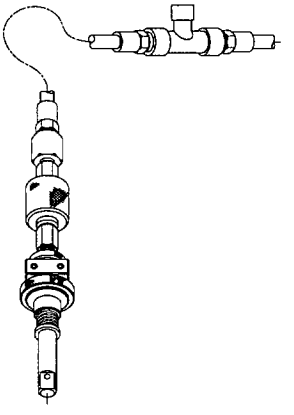
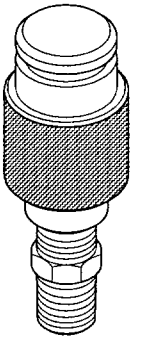
PWC60679 	PWC60684 	PWC60709 **TOOL NOT ILLUSTRATED**
PWC60682 	PWC60685 	PWC60710 
PWC60683 	PWC60708 	PWC60711 

Special Tool Illustrations

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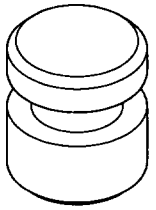
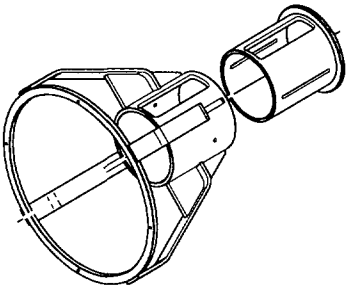
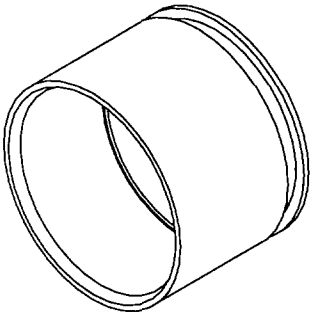
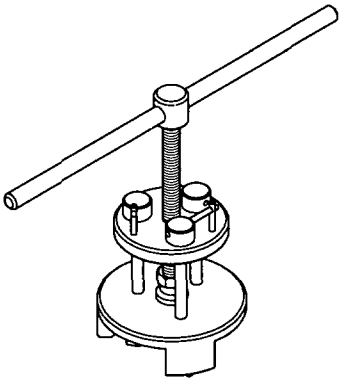
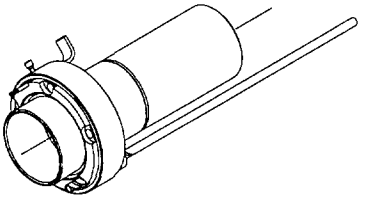
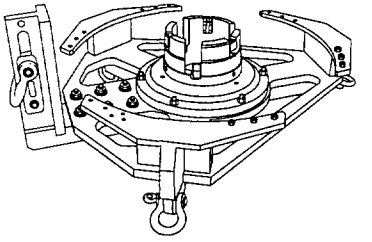
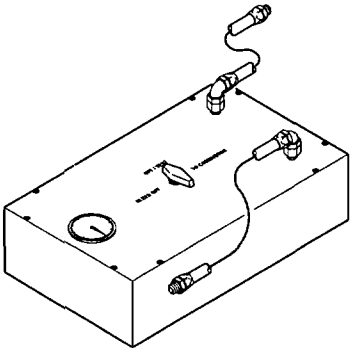
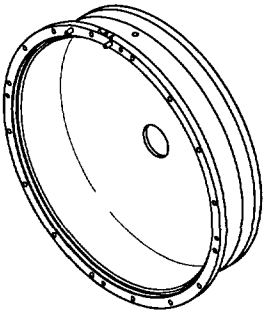
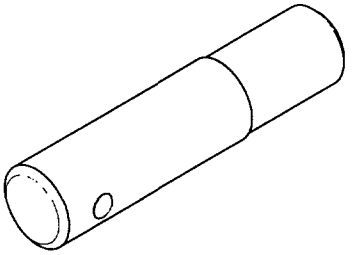
PWC60712 	PWC60719 	PWC60758 
PWC60714 	PWC60731 	PWC60761 
PWC60718 	PWC60738 	PWC60764 

Special Tool Illustrations

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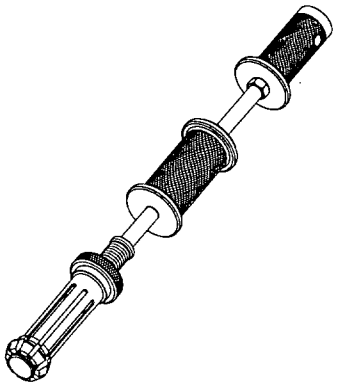
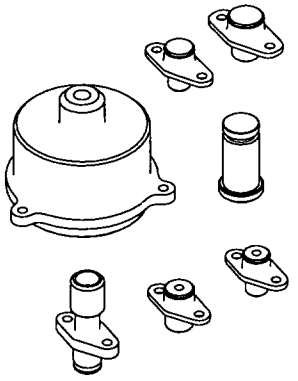
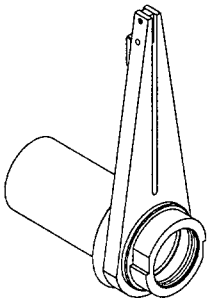
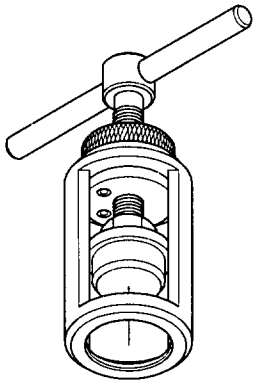
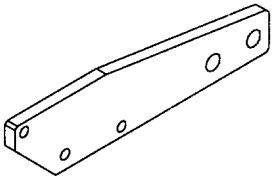
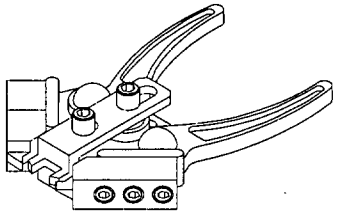
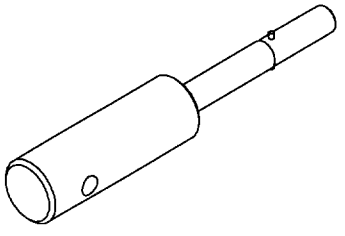
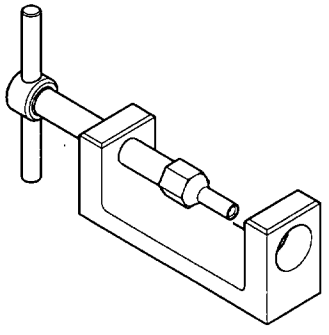
PWC60765 	PWC60786 	PWC60791 
PWC60766 	PWC60787 	PWC60801 **TOOL NOT ILLUSTRATED**
PWC60774 	PWC60788 	PWC60831 

Special Tool Illustrations

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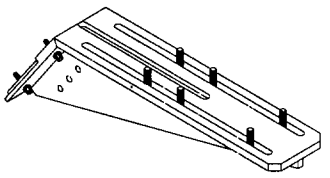
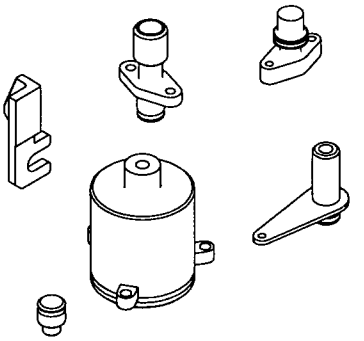
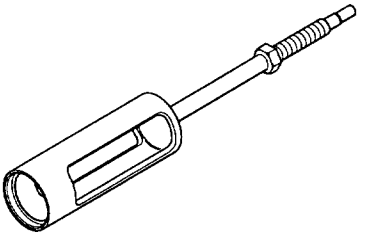
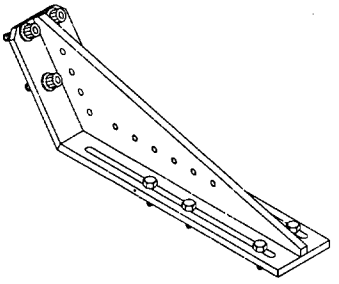
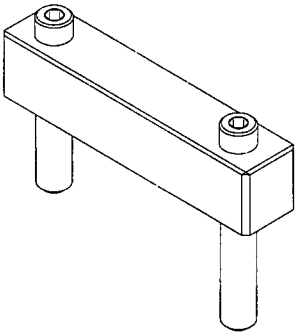
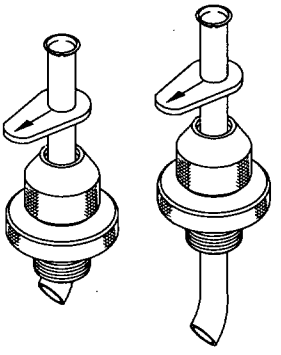
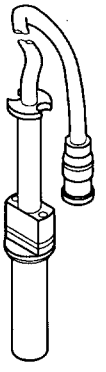
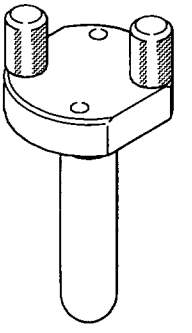
PWC60838 	PWC60879 	PWC60930 
PWC60839 	PWC60899 	PWC61014 **TOOL NOT ILLUSTRATED**
PWC60877 	PWC60916 	PWC61148 

Special Tool Illustrations

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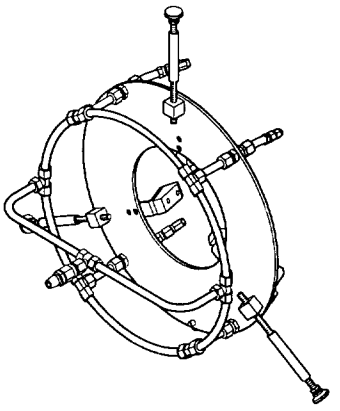
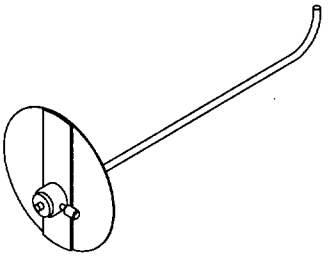
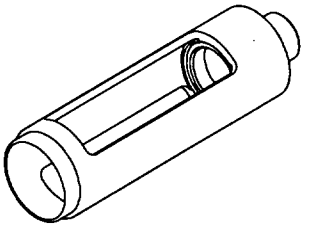
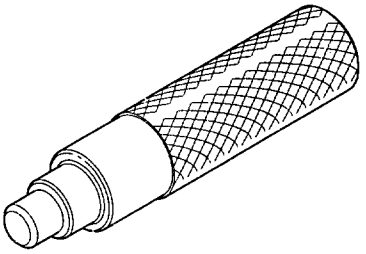
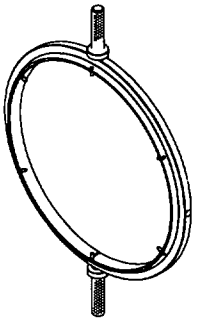
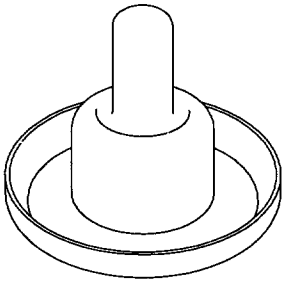
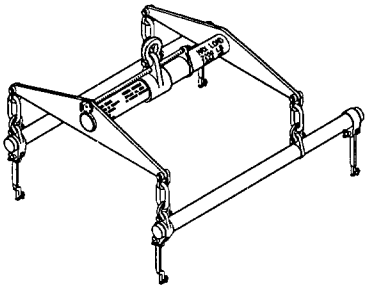
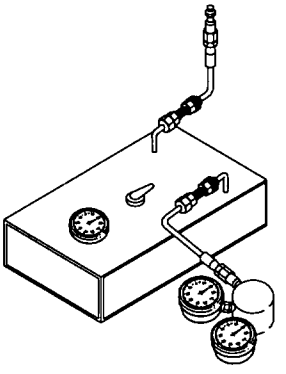
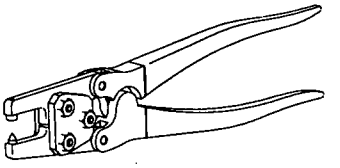
PWC61152 	PWC61592 	PWC61823 
PWC61155 	PWC61783 	PWC62002 
PWC61373 	PWC61792 	PWC62003 

Special Tool Illustrations

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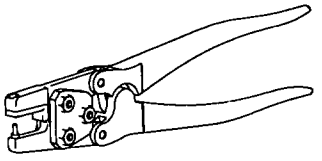
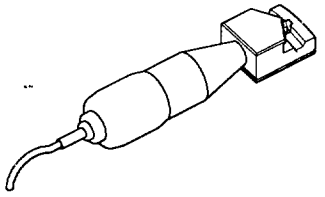
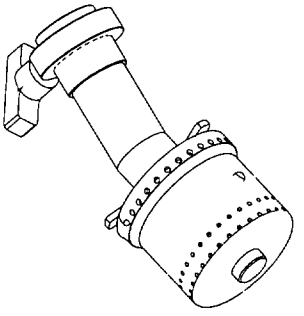
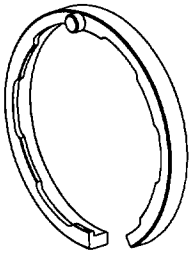
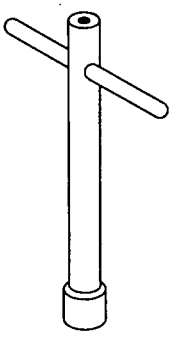
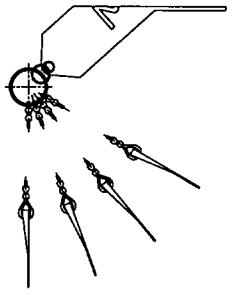
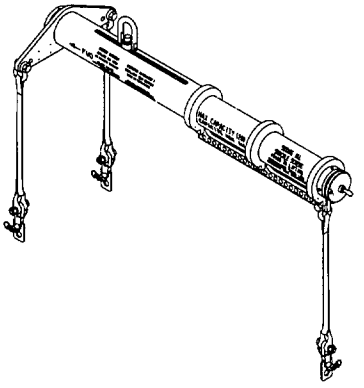
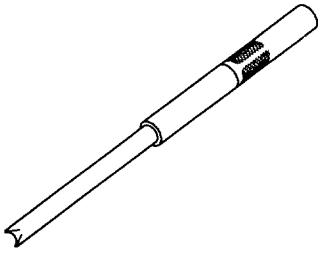
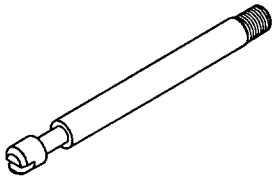
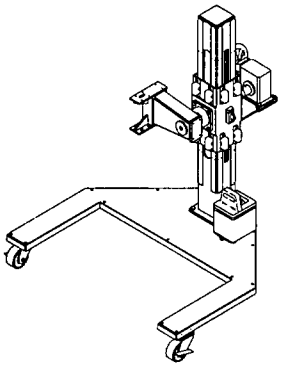
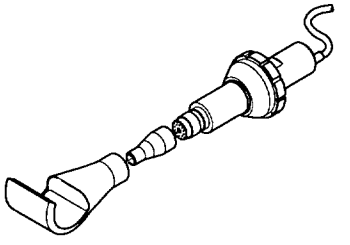
PWC62004 	PWC62458 **TOOL NOT ILLUSTRATED**	PWC62504 **TOOL NOT ILLUSTRATED**
PWC62005 	PWC62502 **TOOL NOT ILLUSTRATED**	PWC63068 
PWC62019 	PWC62503 **TOOL NOT ILLUSTRATED**	PWC63141 **TOOL NOT ILLUSTRATED**

Special Tool Illustrations

P&WC Proprietary Information. Subject to the restrictions on the title page.

PWC63224 **TOOL NOT ILLUSTRATED**	PWC66103 	PWC66581 
PWC63410 **TOOL NOT ILLUSTRATED**	PWC66106 	PWC66645 
PWC64241-3 	PWC66300 	PWC90000 

Special Tool Illustrations

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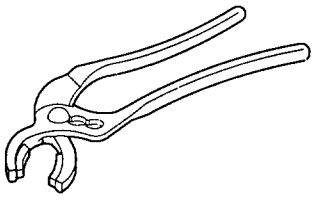
PWC90012



Special Tool Illustrations

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3. Fixtures and Equipment

Table 2 gives a list of the fixtures and equipment required to maintain the engine. The Table also contains the supplier's name and address, when available.

TABLE 2, Fixtures and Equipment

Name	Part No. Or Model	Supplier
TEC ACES Analyzer	Model 1700	Technology Energy Corp. 10737 Lexington Drive, P.O. Box 22996 Knoxville, TN 37932 USA Ph: 865-671-2003 Fax: 865-675-1241 Website: www.acessystems.com
ACES PW500 RAM Card	P/N 11-100-0031	TEC
Signal Conditioning Box	Model 2789	TEC
Speed Unit 517P	P/N 10-100-0485	TEC
Converter box	P/N 10-100-0574	TEC
Optical Probe	P/N 10-100-1773	TEC
High Temperature Cable	P/N 10-320-0008	TEC
Tach Probe Cable	P/N 10-320-0126	TEC
Vibration Sensor Cable	P/N 10-320-0131	TEC
Breakout Splitter	P/N 10-320-0167	TEC
N2 Extension Cable	P/N 10-320-0171	TEC
Comm Cable	P/N 10-320-0180	TEC
Tach Cable	P/N 10-320-0181	TEC
Interface Cable	P/N 10-320-0248	TEC
Optical Probe Bracket	P/N 22-430-0058	TEC
Vibration Sensor	P/N 69-100-0016	TEC

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TABLE 2, Fixtures and Equipment (Cont'd)

Name	Part No. Or Model	Supplier
Test Set	Model TT-1000A	Barfield Instrument Corp. 4101 NW 29th St. P.O. Box 527705 Miami, FL 33152-7705 USA Tel.: (305) 871-3900
Test Set	Fluke Automatic RC2 Meter Model PM6303A	Fluke Electronics Canada Inc 400 Britannia Road, Unit 1 Mississauga, ON Canada L4Z 1X9 Tel: 905-890-7600 or 1-800-363-5853 Fax: (905) 890-6866
Test Set	Impedence Meter Model 253	Electro Scientific Industries Inc 13900 NW Science Pk Dr Portland ON 97229 USA Tel: 503-641-4141
Extractor, Threaded Insert	P/N 1227-06	Tridair Industries 3000 West Lomita Blvd. Torrance, CA 90505 USA or Interfast Inc. 21 Constellation Court Rexdale, ON M9W 1K4 Canada
Installation, Threaded Insert	P/N 7551-06	Tridair Industries or Interfast Inc.
Tang Removal, Threaded Insert	P/N 3695-06	Tridair Industries or Interfast Inc.
Cleaner, Ultrasonic	Various Models - Electrosonic or Ultrasonic	Aircraft Appliances & Equipment Ltd. 150 East Drive. Bramalea, ON Canada L6T 1C1 or

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TABLE 2, Fixtures and Equipment (Cont'd)

Name	Part No. Or Model	Supplier
		Kel-Strom Tool Co. 214 Church St. Wethersfield, CT 06109 USA

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CONSUMABLE MATERIALS

1. General

This section gives data about the consumable materials listed in this manual.

2. Consumable Materials

A. Consumable Material

The term "Consumable Material" shall be defined as referring to an expendable substance which is not separately obtained from Pratt & Whitney Canada and which may be applied to the engine or its parts during maintenance.

B. Trade Names

In many instances, products such as cleaning materials, are mentioned by their trade names to assist the operator in identifying the product types. These names are representative examples only and their inclusion does not necessarily exclude the use of other equivalent products.

C. Specification Numbers

Specification numbers applying to consumable materials are basic and shall be interpreted to include all revisions and amendments thereto.

D. Material Safety Data Sheets (MSDS)

Material Safety Data Sheets contain information about trade name, safety hazards, health hazards, reactivity, spill or leak procedures, special protection information, special precautions, and transportation and labelling are available from manufacturer. Read prior to using consumable materials.

E. Consumable Materials

Table 1 describes consumable materials used in the maintenance of the engine.

TABLE 1, Consumable Materials

Item No.	Material	Specification and/or Manufacturer's Reference	Supplier Code
PWC01-001	Fuel, Engine	Refer to Chapter 72-00-00 Description and Operation	
PWC03-001	Oil, Engine	Refer to Chapter 72-00-00 Description and Operation	
PWC03-002	Fluid, Calibrating	Brayco 922 U.S. MIL-C-7024 Type II	A0015
PWC04-001	Grease, Synthetic General Purpose	US. MIL-G-23827 QPL-23827-18 NATO G-354	A0001

TABLE 1, Consumable Materials (Cont'd)

Item No.	Material	Specification and/or Manufacturer's Reference	Supplier Code
PWC04-003	Grease, Synthetic	Beacon 325	A0001 A0030
PWC05-002	Dye, Layout	LOX compatable Micro Supreme Purple	01058 59460
PWC05-004	Acid, Hydrofluoric Technical Grade	US. Mil-A-24641	A0001 36842
PWC05-005	Emulsifier	Witconate P10-59B	36842 85665
PWC05-006	Acid, Phosphoric Concentrated	Technical Grade	A0001 36842
PWC05-009	Ammonium Bifluoride	Chrystaline	A0001
PWC05-014	Cloth, Abrasive	Scotch Brite	A0001 28112
PWC05-018	Pencil, Metal Marking (Hard)	No. 21628 Silver	22980
PWC05-018A	Pencil, Metal Marking (Hard)	No. 02460 Silver	22980
PWC05-018B	Pencil, Metal Marking (Hard)	No. 02443 Blue	22980
PWC05-018C	Pencil, Metal Marking (Hard)	No. 03341 Green	22980
PWC05-018D	Pencil, Metal Marking (Hard)	Best No. 322 Pink	A0006 70362
PWC05-018E	Pencil, Metal Marking (Hard)	Best No. 349 Red	A0006 70362
PWC05-018F	Pencil, Metal Marking (Hard)	No. 00750 Red	22980
PWC05-018G	Pencil, Metal Marking (Hard)	Best No. 352 White	A0006 70362
PWC05-018H	Pencil, Metal Marking (Hard)	Colorbrite No. 4127 Yellow	22980
PWC05-019	Compound, Lapping	Silicon Carbide Clover 2A 400 grit	05972

TABLE 1, Consumable Materials (Cont'd)

Item No.	Material	Specification and/or Manufacturer's Reference	Supplier Code
PWC05-019A	Compound, Lapping	Silicon Carbide Moonstone Aloxite Resinoid Grade AF-3-J-B	A0001
PWC05-020	Compound, Oil Base Organic	CRC 3-36	A0025 10136
PWC05-038	Hydrogen Peroxide	Commercial Grade 32.5% to 35% US. Fed. A-A-53707	A0001
PWC05-041	Dye, Layout	Dykem Steel Blue	A0001
PWC05-048	Pen, Marking	Brush Pen No. 57	S0036
PWC05-048A	Pen, Marking	Felt Wick Pen	A0013 30133
PWC05-048B	Pen, Marking	Marks-A-Lot Pen	16956
PWC05-050	Nitrogen, Technical Grade	Minimum Purity 99% U.S. BB-N-411	A0001 0BZD7 09563
PWC05-055	Sodium Dichromate	Commercial Grade	A0001
PWC05-056	Sodium Hydroxide	Technical Grade Caustic soda U.S. Fed. O-S-598 NaOH 95% Min. Chloride as NaCL 0.5% Max.	A0001
PWC05-061	Cloth, Abrasive Coated, Crocus	US. A-A-1206	A0001
PWC05-063	Strapping, Steel	U.S. ASTM D3953 Type I, Class A 0.70 in. (17.78 mm) wide 0.023 in. (0.58 mm) thick	A0001
PWC05-068	Tape, Masking General Purpose	Permacel No. 701	99742
PWC05-069	Tape, Pressure Sensitive Waterproof	U.S. Fed. PPP-T-60	A0001
PWC05-070	Tape, Pressure Sensitive Filament Reinforced	3M No. 898 Type II, 2 inch. US. PPP-T-97	A0001 A0083 76381

TABLE 1, Consumable Materials (Cont'd)

Item No.	Material	Specification and/or Manufacturer's Reference	Supplier Code
PWC05-073	Water, Distilled, Deionized or Demineralized	Ref. Commercial Grade PMC 1737	A0001(s)
PWC05-074	Acid, Sulfuric	Commercial or Technical Grade 66 Degrees Baume	A0001
PWC05-077	Oil, Preservative	Grade 1010 U.S. MIL-L-6081 Brayco 460	2R128
PWC05-077A	Oil, Preservative	Grade 1010 U.S. MIL-L-6081 Royco 481	07950
PWC05-077B	Oil, Preservative	Grade 1010 U.S. MIL-L-6081 Winsor L-110-A	85665
PWC05-078	Oil, Releasing	(A mixture of 50% engine fuel (PWC01-001) and 50% engine oil (PWC03-001))	Refer to PWC01-001 and PWC03-001
PWC05-089	Lockwire (CRES)	MS 9226-03 US. AMS 5687 (0.025 in.) (0.635 mm)	A0001
PWC05-105	Tape, Electrical Insulation	Silicone Rubber U.S. Fed. A-A-59163 PWC P/N 31B6258-01	A0001 00198
PWC05-147	Electrode, 2% Thoriated Tungsten	7 in. long x 1/16 in. dia (177.8 mm x 1.6 mm)	A0001 05838 28835
PWC05-161	Solution, Touch-up Chrome Pickle	1.5 pints nitric acid (PWC05-195) and 1.5 pints sodium chromate (PWC05-055) to a specific gravity of 1.42. Add to 8 pints of water.	
PWC05-162	Wetting Agent, Chromate Conversion Salts	Ref. ARP No. 2 PMC 1632	76071 A0001(s)
PWC05-170	Compound, Polishing	Greaseless HD-24 Fine	A0001 75554
PWC05-184	Compound, Potting	EC3524 Two Part	A0001 28112

TABLE 1, Consumable Materials (Cont'd)

Item No.	Material	Specification and/or Manufacturer's Reference	Supplier Code
PWC05-195	Acid, Nitric	Commercial Grade US. O-N-350 5 to 10% Solution 42% Reagent Grade 45 Degrees Baume	A0001
PWC05-196A	Acid, Hydrochloric	Technical Grade Enthone No. 8 US. O-H-765 MIL-H-13528A 37% Reagent Grade 20 Degrees Baume	02258
PWC05-197	Acid, Chromic	Open Flakes or Solution US. O-C-303 Cr03-99.5% Min. SO4 -0.20% Max Commercial Grade	A0001
PWC05-198	Salts, Chromate Conversion (Magnesium)	Ref. IRIDITE 15 PMC 1690	A0001(s) 76071
PWC05-210	Compound, Polishing	No. 2844 Tripoli #418	75554
PWC05-238	Tape Reflective	No. 7610 High Gain Front Projection	A0077 A0082 76381
PWC05-256	Enhancer, Electrical Contact	Stabilant 22	38948
PWC05-272	Compound, Polishing	Greaseless Grade E	75554
PWC05-372	Blue Oil Dye	Ref. Octel Oil Blue B Liquid Dye	1ML15
PWC06-001	Compound, Lubricating	D321 Moly Spray	71984
PWC06-002	Lubricant, Paste	Petrolatum, White Technical Grade US. Fed. AN-P-51	A0001 86459
PWC06-002A	Lubricant, Paste	Petrolatum, White Vaseline	92469
PWC06-002B	Lubricant, Paste	Petrolatum, White Fanoline or Protopet	78369

TABLE 1, Consumable Materials (Cont'd)

Item No.	Material	Specification and/or Manufacturer's Reference	Supplier Code
PWC06-004	Compound, Antiseize	Molybenum Sulphide Paste Dow Corning G-N Metal Assembly Paste	A0001 71984
PWC06-004A	Compound, Anti-seize	Molybenum Disulfide Dow Corning Z Moly Powder and Engine Oil (PWC03-001)	71984
PWC06-004B	Compound, Anti-seize	Molybenum Disulfide Ref. Dow Corning Z Moly Powder US. MIL-M-7866 PMC 9523	71984(m) A0018(s)
PWC06-005	Lubricant, Spray Release Agent	MS-122N/CO2 US. MIL-L-60326	18598
PWC06-005A	Lubricant, Spray Release Agent	Solvent Based MS-143DF	A0001 1DD67 1E473 18598
PWC06-005B	Lubricant, Spray Release Agent	Water Based RCTW 9080	2W738
PWC06-005C	Lubricant, Spray Release Agent	TFL 50 Dry Lube	0TGR5
PWC06-005D	Lubricant, Spray Release Agent	MS-122DF	A0103 1DD67 1E473 18598
PWC06-009	Compound, Anti-seize	NEVER-SEEZE Pure Nickel Special	5W425 75437
PWC06-011	Fluid, Assembly	Ultrachem No.1	56385
PWC06-011A	Fluid, Assembly	Royco HF825	07950
PWC06-015	Beeswax	Dilwax No. 35 Amphorous	37682
PWC06-023	Compound, Anti-seize	Silver Goop	A0019 A0037 A0038 02570
PWC06-032	Compound, Anti-galling and Anti-seize (High Temperature)	Loctite C-200 US. MIL-A-907	A0104 05972

TABLE 1, Consumable Materials (Cont'd)

Item No.	Material	Specification and/or Manufacturer's Reference	Supplier Code
PWC06-032A	Compound, Anti-galling and Anti-seize (High Temperature)	Ease-Off 990 US. MIL-A-907	87889
PWC06-032B for fasteners only	Compound, Anti-galling and Anti-seize (High Temperature)	Kaylube No. 3 US. MIL-A-907	15653
PWC07-011	Varnish	Air Dry Cromac 451 Special Poly Vinyl Acetate	A0001 36056
PWC07-011A	Varnish	Air Dry Cromac 452 Special Concentrate	A0001 36056
PWC07-014	Varnish, Phenolic Resin	Corrosion Preventative 69X-0545 AMS 3132	78520
PWC07-014A	Varnish, Phenolic Resin	Corrosion Preventative US MIL-R-3043	A0001
PWC08-014	Adhesive, Industrial	Loctite Quick-Set 404	A0104 05972
PWC08-016	Paste, Adhesive Epoxy Base	EA 934 NA	33564
PWC08-016A	Paste, Adhesive *Hardener*	EA9349	33564
PWC09-001	Sealant, Silicone Rubber	Silastic 732 RTV	71984 D8367 K7750
PWC09-001A	Sealant, Silicone Rubber	RTV 102, 103, 108 and 109	01139
PWC09-002	Compound, Locking and Retaining	Loctite Grade 290 US MIL-S-22473	A0018 A0104 A0115 A0116 D2617 U0406 05972
PWC09-002A	Compound, Locking and Retaining	Loctite Grade 222 US MIL-S-22473	A0018 A0104 A0115 A0116 D2617 U0406 05972

TABLE 1, Consumable Materials (Cont'd)

Item No.	Material	Specification and/or Manufacturer's Reference	Supplier Code
PWC09-002B	Compound, Locking and Retaining	Loctite Grade 620 US MIL-S-22473	A0018 A0104 A0115 A0116 D2617 U0406 05972
PWC09-002C	Compound, Locking and Retaining	Loctite Grade 609 US MIL-S-22473	A0018 A0104 A0115 A0116 D2617 U0406 05972
PWC09-002D	Compound, Locking and Retaining	Loctite Grade 680 US MIL-S-22473	A0018 A0104 A0115 A0116 D2617 U0406 05972
PWC09-003	Compound, Sealing	Silicone Rubber Dow Corning No. 4 U.S. MIL-S-8660	71984 D8367
PWC09-017	Adhesive, Sealant	Silicone Rubber RTV 106	01139 74230 98500
PWC09-017A	Adhesive, Sealant	Silicone Rubber Silastic RTV 736	71984
PWC09-019	Adhesive/Sealant	Silicone Rubber RTV 157	01139
PWC09-025	Adhesive/Sealant	Silicone Rubber RTV 88	01139
PWC11-001	Cleaner, Engine Internal	Alkaline CLIX	20913 56444
PWC11-001A	Cleaner, Engine Internal	Alkaline Almon AL-333	A253
PWC11-001B	Cleaner, Engine Internal	Alkaline Magnus 1214	02ER0 85884
PWC11-001C	Cleaner, Engine Internal	Alkaline B&B 31000	21361

TABLE 1, Consumable Materials (Cont'd)

Item No.	Material	Specification and/or Manufacturer's Reference	Supplier Code
PWC11-001D	Cleaner, Engine Internal	Alkaline R-MCS	N1480
PWC11-001E	Cleaner, Engine Internal	Alkaline Ref. R-MC-G21	N1480
PWC11-001F	Cleaner, Engine Internal	Alkaline Turco 4217 Concentrate	36325 2F245
PWC11-001G	Cleaner, Engine Internal	Alkaline Turco T-5884	36325 2F245
PWC11-001H	Cleaner, Engine Internal	Alkaline Ardox 624 (Concentrate)	37127 K6858
PWC11-001I	Cleaner, Engine Internal	Alkaline Carbitol	A0001
PWC11-001J	Cleaner, Engine Internal	Alkaline Triethanolamine	A0001
PWC11-002	Solvent, Cleaning See Note	Trichloroethane Inhibited 1,1,1	A0001
	Note: Use PWC11-014 as an alternate when the use of PWC11-002 is restricted due to environmental and/or health regulations.		
PWC11-003	Cleaner, Engine Internal	Detergent Biodegradable Ardox 6345	K6858 23373 37127
PWC11-003A	Cleaner, Engine Internal	Detergent Biodegradable R-MCS-G21	N1480 58913
PWC11-003B	Cleaner, Engine Internal	Detergent Biodegradable Turboclean 2	A0041
PWC11-003C	Cleaner, Engine Internal	Detergent Biodegradable Turboclean 2 RTU (Ready To Use)	A0041
PWC11-003D	Cleaner, Engine Internal	Detergent Biodegradable Zok 27	A0042 S0027
PWC11-003E	Cleaner, Engine Internal	Detergent Biodegradable B & B TC100	21361
PWC11-012	Solvent	Acetone	A0001

TABLE 1, Consumable Materials (Cont'd)

Item No.	Material	Specification and/or Manufacturer's Reference	Supplier Code
PWC11-014	Solvent	Isopropy Alcohol U.S. Fed. TT-I-735 Grade A	A0001
PWC11-016	Perchlorethylene (Inhibited)	Vapor Degreaser Grade US. O-T-236	A0001
PWC11-019	Solution, Chromate Conversion Magnesium Alloy	Ref. Open US. AMS 2475	A0001(s)
PWC11-021	Compound, Carbon Removing (Cold)	Mag-Chem Turco Super Carb	02ER0
PWC11-022	Solvent, Cleaning See Note	Methyl-Ethyl-Ketone (MEK) US. ASTM D740	A0001 36842
	Note: Use PWC11-014 as an alternate when the use of PWC11-022 is restricted due to environmental and/or health regulations		
PWC11-027	Solvent, Cleaning	Petroleum Based Stoddard US. AMS 3160 P-D-680 Type 1	A0001 36131
PWC11-027A	Solvent, Cleaning	Petroleum Based Varsol 140	A0001
PWC11-027B	Solvent, Cleaning	Petroleum Based Varsol 140	A0001
PWC11-027C	Solvent, Cleaning	Petroleum Based SAFETY-KLEEN Premium No. 6605	30530
PWC11-027D	Solvent, Cleaning	Petroleum Based Solvent 140-3% Aromatics	34897
PWC11-027E	Solvent, Cleaning	Petroleum Based Ardox 5412	A0052 K6858 23373 37127
PWC11-027F	Solvent, Cleaning	Petroleum Based Alphatic Hydrocarbon ASTM D-235 Type 4 US Fed. P-D-680 Type 1	A0001 A0040
PWC11-027G	Solvent, Cleaning	Petroleum Based Van-Sol 142	A0001 A0040

TABLE 1, Consumable Materials (Cont'd)

Item No.	Material	Specification and/or Manufacturer's Reference	Supplier Code
PWC11-027H	Solvent, Cleaning	Petroleum Shell Sol 140/142	A0001 A0040
PWC11-027I	Solvent, Cleaning See Note	Petroleum Varsol 60	A0001 9X193
	Note: Use PWC11-031 as an alternate when the use of PWC11-027 is restricted due to environmental and/or health regulations.		
PWC11-031	Solvent, Cleaning	Mag-Chem Tergit	02ER0
PWC11-036	Solvent, Deoxidizer Electrical	Cramolin "Pro Gold" G5S-6	55403
PWC11-041	Solvent, Degreaser	Actrel 3338L	A0030
PWC11-048	Solvent, Cleaner	Mag-Chem Teksol	02ER0
PWC11-051	Preservative	Aerosol Spray Caig PreserviT P5S-6	55403
PWC11-061	Cleaner, Rust Remover	Mag-Chem HDL-202	02ERO
PWC11-063	Cleaner, Rust Remover	Ardox 185L, Liquid	K6858
PWC11-064	Cleaner, Rust Remover	Turco 4181L, Liquid	OBYN5
PWC11-065	Cleaner, Rust Remover	Turco 4781-7, Powder	OBYN5

F. Supplier Codes and Addresses

Table 2 gives the list of Supplier Codes and Addresses for the Consumable Materials.

TABLE 2, Supplier Codes and Addresses

Supplier Code	Name/Address
A0001	Local Supply Local Purchase
A0002	Butterfield (Litton) 91 Cornella St. West Smith Falls, ON Canada K7A 4T3 Tel: 613-283-8001 Telex: 05-33934

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
A0006	Dixon Ticonderoga Inc. 531 Davis Drive Newmarket, ON Canada L3Y 2P1 Tel: 905-263-4966 Fax: 905-895-9555
A0011	International Paints Industrial Coatings Rotton Park Street Birmingham England B16 0AD
A0013	Speedry Products Inc. Richmond Hill, NY 11418 USA
A0014	Kingsley and Keith Canada Ltd. 1010 de Sevigny, 7th Floor Longueuil, QC Canada J4K 5G7 Tel: 514-442-4394
A0015	Castrol Canada Inc. 2150 Rue Frances Hughes Chomedy Ville de Laval QC Canada H7S 1N7 Tel: 450-382-6940 or 900-361-3837
A0018	National Bearings Ltd. 724 Renaud Dorval, QC Canada H9S 1H5 Tel: 514-333-7000
A0019	Vannes & Raccords Laurentian Ltee. 2425 Halpern Ville St. Laurent, QC Canada H4S 1S3 Tel: 514-332-3651 Fax: 514-332-4386
A0025	Carlin Product Co. 1246 Lorimar Drive Unit 22 Mississauga, ON Canada L5S 1R2

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
A0030	Imperial Oil Canada 111 St. Clair Ave. W Toronto, ON M5W 1K3 Canada Tel: 416-968-4111 Fax: 416-968-4374
A0037	Amsterdam Valve & Fitting BV P.O. Box 9050 1180 MD Amstelveen The Netherlands Tel: 31-20-6470231 Fax: 31-20-6474267
A0038	Singapore Valve & Fitting (Pte) Ltd. 28 Mandal Estate Singapore 2572 Tel: 65-3670688 Fax: 65-3685300
A0041	Trafficair The Kent Chemical Co. Ltd. George House, Bridgewell Lane Tenderden Kent England TN30 6HS
A0042	Airworthy Ltd. Elsted Midhurst West Sussex England GU29 0JT Tel: 730-816672 Fax: 730-815607
A0051	Lufkin Corporation 7 Walnut Hill Park Woburn, MA 01801 USA
A0052	Trikon Technologies Inc. 6969 Trans-Canada Highway Suite 127 Saint-Laurent, QC H4T 1V8 Canada Tel: (514) 339-5997
A0076	Corrosion Solutions P.O. Box 5500998 Dallas, TX 75355-9998 USA

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
A0077	Cine sound and Projection 258 Raleigh Ave. Toronto ON Canada M1V 1B7 Tel: 800-3M-HELPS Fax: 416-269-7991 email: cinesound@attcanada.net
A0082	Technology Energy Corp. 10737 Lexington Dr. Knoxville, TN 37932 USA
A0084	Millipore Canada Ltd. 36 Antares Drive Suite 700 Nepean, ON Canada K2E 7W5 Tel: 800-645-5476 Fax: 613-225-9366
A0103	Miller-Stephenson Chemical Co. Inc. 514 Carlingview Dr. Rexdale, ON Canada M9W 5R3 Tel: 416-675-3204 or 800-323-4621 Fax: 416-674-2987 Website: www.miller-stephenson.com
A0104	Loctite Canada Inc. 2225 Meadowpine Blvd. Mississauga, ON L5N 7P2 Canada Tel: 800-263-5042 Fax: 905-814-5391 Website: www.loctite.com
A253	Almon Quimico Wyandotte Corporation Rio De Janeiro Brazil
D2617	Loctite Deutschland GmbH Arabellastrasse 17 Postfach 81 05 80 8000 Munchen 81 Germany
D8367	Dow Corning GmbH Schmierstoffe Pelkovenstrasse 152 8000 Muenchen 50 Germany

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
F1419	International Celomer S.F.P.V. B.P. 168 75 Blvd. Winston Churchill Le Harve Cedex France F-760502 Tel: 35-535400 Fax: 35-535405
K3237	Marston Bentley Ltd. 9 Naylor Street Liverpool England L3 6DS
K6858	Brent International PLC Ridgeway Iver Bucks England SLO 9JJ Tel: 44-1753-651812 Telex: 847693 Fax: 44-1753-652460
K7750	Dow Corning Ltd. (Molykote Division) Kings Court 185, Kings Road Reading Berks England RG1 4EX
N1480	Ivar Rivenaes A/S Damsgirds 35 N-5037 Solheimsvik Norway Tel: 55203390 Fax: 55295925
S0004	Empire Berol 105 West Park Drive P.O. Box 2248 Brentwood, TN 37024-2248 USA Tel: 615-371-1199 Fax: 615-371-1903
S0011	Keough & Associates 210 Tumblebrook Rd. Meriden, CT 06450 USA

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
S0018	Dow Corning Corp. Rubber Finishing Unit 50 Commerce Drive Trumbull, CT 06611 USA
S0027	Modern Chemical Inc. P.O. Box 368 Jacksonville, AR 72076 USA Tel: 501-988-1311 Fax: 501-988-2229
S0036	Texrite Products Co. 10333 Shoemaker St. Detroit, MI 48213 USA Tel: 313-925-9002 Fax: 313-925-9602
S0081	Lucas Avitron P.O. Box 120039 Stanford, CT 06912 USA Tel: 203-351-8400 Fax: 203-351-8444
S0089	Avery Dennison Dennison Division One Clark Hill Farmington, MA 01701 USA Tel: 508-879-0511 Fax: 508-383-4259 or Office Products Canada 200 Base Line Rd E Bowmanville, ON L1C 1A2 Canada Tel: 905-623-6311 Fax: 905-623-9751
U0406	Loctite (UK) Ltd Watchmead, Welwyn Garden City Herts England AL7 1JB

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
0BYN5	Turco Products Inc. Sub. of Elf Atochem North America 3300 Montreal Industrial Way Tucker GA 30084-5290 USA Tel: 770-939-8332 Fax:770-496-5830
0BZD7	Liquid Air Engineering Corp. 1155 Sherbrooke St. W. Montreal, QC H3A 1H8 Canada Tel: 514-842-5431 Fax: 514-499-8102
0NOL1	Trafficair Inc. 200 Technology Drive Alpharetta, GA 30201 USA Tel: 404-475-5255 Fax: 404-442-1937
0NYS9	Courtaulds Aerospace 5454 San Fernando Road P.O. Box 1800 Glendale, CA 94538 USA Tel: 818-240-2060 Fax: 818-549-7575
0SNH2	Industrial Steel and Wire Co. 1901 N. Narragansett Ave. Chicago, IL 60639 USA Tel: 800-767-0408 Fax: 312-804-0408
0TGR5	Distec Inc. International Enterprise Pk. Bldg 777 939 Barnum Ave. Bridgeport, CT 06608 USA Tel: 203-334-0383 Fax: 203-576-6769

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
00198	Pratt & Whitney Canada Inc. Attn: Parts Support 01OE4 1000 Marie Victorin Longueuil, QC J4G 1A1 Canada Tel: 514-647-2777 Fax: 514-647-2834
01058	Michigan Chrome & Chemical Co. 8615 Grinnel Ave. Detroit, MI 48213-1152 USA Tel: 313-267-5279
01139	General Electric Co. Silicone Sales Dept. Customer Service 260 Hudson River Rd. Waterford NY 12188 USA Tel: 519-233-3330 or 800-255-8886
01139	General Electric Co. 260 Hudson River Road Waterford, NY 12188 USA Tel: 800-255-8886 Fax: 518-233-3931
02ER0	Magnus Chemical Ltd. (MAG - CHEM INC.) 190 Blvd. Industriel Boucherville, QC J4B 2X3 Canada Tel: 514-655-1344 Fax: 514-655-5428
02258	Enthone-OMI Inc. P.O. Box 1900 New Haven, CT 06516-4147 USA Tel: 203-932-8618 Fax: 203-937-1680
02570	Crawford Fitting Co. 29500 Solon Road Solon, OH 44139 USA Tel: 216-248-4600 Fax: 216-49-5970

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
03530	American Gas & Chemicals Co. Ltd. 220 Pegasus Ave. Northvale, NJ 07647-1904 USA Tel: (201) 767-7300 Tel: (800) 288-3647 Fax: (201) 767-1741
05838	Philips Elmet Corp. 1560 Lisbon Rd. Lewiston, ME 04240 USA Tel: 207-784-3591 or 800-526-7480
05972	Loctite Corporation 1001 Trout Brook Crossing Rock Hill, CT 06067-3910 USA Tel: 800-828-2524 Fax: 860-571-5465
06565	Norton Co. (for Domestic Orders) Coated Abrasive & Tape Division 2600 Tenth Avenue Watervilet, NY 12189 USA Tel: 518-266-2200 Fax: 518-266-2342
07950	Royal Lubricants Co. Ltd. 1 Merry Lane East Hanover, NJ 07936 USA Tel: 973-887-7410 or 800-989-7692 Fax: (973) 887-6930
08071	Millipore Corporation 80 Ashby Road Bedford, MA 01730-2271 USA Tel: 617-275-9200 Fax: 617-275-5550

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
08338	Allied Chemicals Canada Ltd. Fluorine Products 201 City Centre Dr. Mississauga, ON Canada L5B 2T4 Tel: 416-276-9211 Fax: 416- 276-5711
09185	Litton Industries Kester Solder Division 515 E. Touhy Ave. Des Plaines, IL 60018-2675 USA Tel: 708-297-1600 Fax: 708-390-9338
09563	Liquid Carbonic Canada Ltd 255 Brimley Rd. Toronto, ON M1M 3J2 Canada Tel: 416-266-3161 Fax: 416-266-0639
09581	3M Canada Inc. 1840 Oxford St. E. P.O. Box 5757 Terminal A London, ON Canada N6A 4T1 Tel: 519-451-2500 Telex: 064-5886 Fax: 519-452-6262
1C394	Dulson Frank and Co. Ltd. 5760 Pare Street Montreal, Quebec H4P 1R9 Canada Tel: 514-735-4681 Fax: 514-735-8566
1DD67	Miller-Stephenson Chemical Co. Inc. 6348 Oakton St. Morton Grove, IL 60053 USA Tel: 847- 966-2022 or 800-992-2424 Fax: (847) 966-8468 Website: www.miller-stephenson.com

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
1E476	Miller-Stephenson Chemical Co. Inc. 12261 Foothill Blvd Sylamar, CA 91342 USA Tel: 818-896-4714 or 800-992-2424 Fax: (818) 896-6086 Website: www.miller-stephenson.com
10136	C R C Industries 885 Louis Dr. Warminster, PA 18974-2820 USA Tel: 215- 674-4300 Fax: 215-674-0651
10178	Kester Solder Co. of Canada Ltd. 1 Prince Charles Road P.O. Box 474 Brantford, ON N3T 5N9 Canada Tel: 519-753-3425 Fax: 519-753-0641
14088	Mequiars Inc. 17991 Mitchell Street P.O. Box 17177 Irvine, CA 92715 USA Tel: 714-752-8000 Fax: 714-833-8814
15653	Microdot Inc. Microdot Aerospace Fastening Systems Kaynar Mfg. Div. 800 South State College Blvd. Fullerton, CA 92634 USA Tel: 714-71-1550
16956	Dennison Mfg. Co., Identification Systems Div. Clark Hill Farmington, M 01701-8164 USA Tel: (508) 879-0511 Fax: (508) 383-4259 or

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
	Office Products Canada 200 Base Line Rd E Bowmanville, ON Canada L1C 1A Tel: 905-623-6311 Fax: 905-623-9751
18598	Miller-Stephenson Chemical Co. Inc. 55 Backus Avenue Danbury, CT 06810 USA Tel: 203-743-4447 Fax: 203-791-8702
2R128	Castrol Inc. Speciality Products Division Suite 230 16715 Van Karman Ave. Irvine, CA 92714 USA Tel: (714) 660-9414 or 800-458-5823, Ext. 3012 Fax: (714) 660-9374
2W738	Chem-Trend Inc. 1445 West McPherson Park Dr. P.O. Box 860 Howell, MI 48844-0860 USA Tel: 517-546-4520 or 800-727-7730 Fax For orders: 517-546-8910
21361	B&B Chemical Co., Inc. 875 W. 20th St. Hialeah, FL 33010-2310 USA Tel: (305) 888-5247 Fax: (305) 887-4587 or P.O. Box 660776 Miami 33266 0776 USA

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
22980	Sanford (A Newell Co.) 2711 Washington Blvd. Bellwood, IL 60104 USA Tel: 708-649-3513 Fax: (708) 649-3594 Website: www.sanfordcorp.com
23373	Brent America Inc. 16961 Knott Avenue La Mirada, CA 90638-6015 USA Tel: 714-739-2821 Fax: 714-670-6480
28112	Minnesota Mining & Mfg. Co. 3M Company Industrial Chemical Products 3M Center St. St. Paul, MN 55144 -1000 USA Tel: 800-364-3577 Fax: (612) 737-7117 Web: www.3m.com
28835	Enthone-OMI Inc. P.O. Box 1900 New Haven, CT 06508 USA Tel: 203-932-8618 Fax: 203-937-1680
30133	Ideal Stencil Machine and Tape 102 Iowa Ave. P.O. Box 305 Belleville, IL 62222-0305 USA Tel: 618-233-0162
32988	Faber-Castell Corp. 551 Spring Place Road P.O. Box 330 Lewisburg, TN 37091-3447 USA Tel: 615-359-1583 or 800-835-8382 Fax: 615-359-7680

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
33333	Washington Mills Electro Minerals Corp. 1801 Buffalo Avenue Niagara Falls, NY 14302 USA Tel: 716-278-6600 Tel: 800- 828-1666
33564	Dexter Aerospace Materials Division 2850 Willow Pass Rd. Pittsburg PA 94565-3299 USA Tel: 510-458-8000 Fax: 510-458-8030 or Dexter Aerospace Electronic Materials Division 211 Franklin St. Olean NY 14760 USA Tel: 716-372-6300 Fax: 716-372-6864
33777	Pactra Industries 420 S. 11th St. P.O. Box 280 Upland, CA 91786-6828 USA Tel: 714-946-3871
36056	Cromac Chemical Co. Ltd. 80 Summerlea Rd. Brampton ON Canada L6T 4X3 Tel: 905-458-1999 Fax: 905-458-7899 or Produits Chimiques Cromac Quebec Ltee 5473 Royalmount Ave., Ste 221 Montreal QC Canada H4P 1J3 Tel: 514-739-0236 Fax: 514-739-3659

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
36131	Shell Canada Limited 400-4th Ave. S.W. Calgary, AB Canada T2P 0J4 Tel: 403-691-3111 Fax: 403-269-4183
36272	The Carborundum Co. Fibers Division 2351 Whirpool St. P.O. Box 808 Niagara Falls, NY 14302 USA Tel: 800-278-2440 Fax: 716-278-4862
36325	Deane & Co. Div. of Groulx-Robertson Ltee/Ltd. 190 Oneida Drive Pointe Claire, QC H9R 1A8 Canada
36382	Witco Canada Ltd. 2 Lansing Square Suite 1200 Willowdale, ON M2J 4Z4 Canada Tel: 416-497-9991 Fax: 416-497-7110
36842	Anachemia Canada Inc. 255 Norman Ville St. Pierre, QC Canada H8R 1A3 Tel: 514-489-5711 Fax: 514-363-5281
37127	Brent Canada Ltd. 363 Arvin Ave. Stoney Creek, Ontario L8E 2M8 Canada Tel: 905- 662-8046
37676	Magnaflux Corp. 7300 West Lawrence Avenue Chicago, IL 60656-3504 USA Tel: 708- 867-8000 Fax: 708- 867-6833

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
37682	Dilmont Inc. 121Bates Rd. Montreal QC H2V 1B1 Canada Tel: 514-272-5741 Fax: 514-277-5764
38948	D.W. Electrochemicals Ltd. 97 Newkirk Road North Richmond Hill, ON L4C 3G4 Canada Tel: 905-508-7500 Fax: 905-508-7502 www.stabilant.com
44197	Norton Co. (Export Sales) 1 New Bond Street P.O. Box 15008 Worchester, MA 01606-0008 USA Tel: 508-795-5000 Fax: 508-795-5868
5P414	E.I. Dupont de Nemours Co. Inc. Petrochemicals Dept. Freon Products Division 1251 Brandywine Bldg. Wilmington, DE 19898 USA Tel: 800-441-7515
5W425	Emhart Corp. Bostik Division Boston Street Middleton, MA 01949 USA Tel: 508-777-0100 Fax: 508-750-7212
55403	Caig Laboratories Inc. 1200 Thatcher Court Poway, CA 92064 USA Tel: 858-486-8388 Fax: 858-486-8398 E-mail: caig123@caig.com Website: www.caig.com

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
56385	Ultrachem Inc. 1400 North Walnut St. P.O. Box 2053 Wilmington, DE 19899 USA Tel: 302-571-8520 Fax: 302-571-9989
56444	National Chemsearch 245 Orenda Road Bramalea ON L6T 1E7 Canada Tel: 800-268-0804 Fax: 416-457-5220
56883	Penetone Corp. Sub. of West Chemical Products Inc. 74 Hudson Ave. Tenafly, NJ 07670-1017 USA Tel: 201-567-3000 Fax: 201-569-5340
58913	Sermatech International Inc. Sub. of Teleflex Inc. 155 South Limerick Road Limerick, PA 19468-1603 USA Tel: 215-948-5100 Fax: 215-948-0811
59460	Pyramid Plastics Inc. Tolbar Division 220 West 5th St. Hope, AR 71801-5212 USA Tel: 501-777-5759 Fax: 501-777-8056
62596	Micro Abrasives Corp. 720 Southhampton Road P.O. Box 517 Westfield, MA USA Tel: 413-562-3641 Fax: 413-562-7409

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
63262	Textron Speciality Materials Sub. of Textron Inc. 2 Industrial Ave. Lowell, MA 01851-5107 USA Tel: 508-452-8961 Fax: 508-454-5619
66724	LPS Laboratories Division of Holt Lloyd Corp. 4647 Hugh Howell Road Tucker, GA 30084-5004 USA Tel: 404-934-7800 Fax: 404-493-9206
70362	Dixon Ticonderoga Co. Sandusky Division 1706 Hayes Avenue P.O Box 2258 Sandusky, OH 44870-4732 USA Tel: 419-625-9545 Fax: 419-625-0719
71361	McGean-Rohco Inc. Cee-Bee Chemical Division 9520 E. Cee Bee Drive P.O. Box 7000 Downey, CA 90241-5501 USA Tel: 310-803-4311 Fax: 310-803-6701
71984	Dow Corning Corp. 3901 South Saginaw Road P.O. Box 994 Midland, MI 48686-0994 USA Tel: 800-248-2481 Fax: 517-496-6974 or Dow Corning Corp. Canada 6747 Campobello Rd. Mississauga, ON L5N 2M1 Canada Tel: 905- 826-9600 Fax: 905-858-6005

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
75437	EOE, Inc. 585 Fourth St. P.O. Box 177 Troy, NY 12181 USA Tel: 518- 272-6922 Fax: 518-272-2182
75554	Jackson Lea A Unit of Jackson Inc. 75 Progress Lane P.O. Box 71 Waterbury, CT 06705 USA Tel: 203-753-5118 Fax: 203-754-3770 or 1701 Highway 70 East Conover, NC 28613 USA
76381	3M Company 3M Center St. Paul, MN 55144-1000 USA Tel: 612-737-6501 or 800-364-3577 Fax: 612-737-7117
78369	Witco Corp. 1 American Lane Greenwich, CT 06831-2559 USA Tel: 203-552-2000 Fax: 203-552-2891
78520	Stan Chem Inc. 401 Berlin St. East Berlin, CT 06023-9706 USA Tel: 860-828-0571 or 800-424-9300 Fax: 203-828-3297
8R348	Stanley Steel Division of Stanley Works Corp. 65 Burrett St. New Britain, CT USA

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
8W577	Aerospace Specifications Metals 1384 W. McNab Rd. Ft. Lauderdale, FL 33309 USA Tel: 305-977-0666 Fax: 305-977-3858
81397	M.W. Dunton Co. 3 Bridal Ave. West Warwick, RI 02893-2901 USA
84063	Henkel Corp. Horsham Business Center 300 Welsh Road Bldg. 2, Suite 1 Horsham, PA 19044 USA Tel: 215-830-1212
84163	Borden Inc. Consumer Products Division 180 E. Broad St. Columbus, OH 43215 USA Tel: 614-225-3333
84330	Treibacher Schleifmittal Corp. 2000 College Ave. MPO 1438 Niagara Falls, NY 14305-1734 USA Tel: 800-394-8872 Fax: 716-286-1261
85570	Courtaulds Aerospace 1608 4th Street Berkley, CA 94710 USA Tel: 510-26-1525
85665	Witco Corp. 1 American Lane Greenwich, CT 06831-2559 USA Tel: 800-494-8287 Tel: 888-544-3199 Fax: 203-552-2849 Fax: Intl: 203-552-3414

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
85884	*Ecolab Inc.* Ecolab Center 370 Wabasha St. St. Paul, MN 55102-1307 USA Tel: 612-293-2570
86459	Penreco 138 Petrolia St. Karns City, PA 16041 USA Tel: 800- 245-3952 Fax: 724-756-1050
87889	The Texacone Co. 4111 Forney Road Mesquite, TX 75149-2722 USA Tel: 800-235-2727
88375	Wyandotte Paint Products Co. 650 Stephenson HWY. P.O. Box 1196 Troy, MI 48099 USA
88597	Volger Mfg. Co. 82 Fulton Street Elizabeth, NJ 07206 USA
89204	Washington Mills Minerals Corp. North Main Street North Grafton, MA 01536 USA *Tel: 508-839-6511* Fax: 508-839-7675
92469	Chesebrough-Ponds Inc. 33 Benedict Place Greenwich, CT 06830-5339 USA Tel: 203-661-2000 Telex: 965877 Fax: 203-625-1345
98148	Dykem Co. 8501 Delport Dr. St. Louis, MO 63114-5905 USA Tel: 800-323-9536 Fax: 314- 423-9545

TABLE 2, Supplier Codes and Addresses (Cont'd)

Supplier Code	Name/Address
99742	Permacel Div. of Nitto Penko America U.S. Highway No. 1 P.O. Box 671 New Brunswick, NJ 08903 USA Tel: 908-418-2400 Fax: 908-418-2474

CHAPTER

04

AIRWORTHINESS LIMITATIONS

TABLE OF CONTENTS

SUBJECT PAGE

RECORD OF AIRWORTHINESS LIMITATIONS REVISIONS

AIRWORTHINESS LIMITATIONS

1. General 1
2. Rotor Component Cyclic Life Limits 1
   - A. General 1
   - B. Service Life Marking Method 2

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Sep 12/2008
	2 blank	Sep 12/2008
Contents	1	Sep 12/2008
	2 blank	Sep 12/2008
Record of AWL	1	Sep 12/2008
Revisions	2 blank	Sep 12/2008
Airworthiness	1	Sep 12/2008
Limitations	2	Sep 12/2008
	3	Sep 12/2008
	4	Sep 12/2008
	5	Sep 12/2008
	6	Sep 12/2008
	7 deleted	
	8 deleted	

P&WC Proprietary Information. Subject to the restrictions on the title page.

Record of Airworthiness Limitations Revisions

Location	Description of Change	Date of Approval
Table 1	Post-SB24477 HP Rotor, 2nd, 3rd and 4th stage disks added.	June 6, 2000
Table 1	Post-SB24469 Impeller added to Rotor Components Service Life Table.	Sep 01, 2000
Para. 2. A.	Step added to clarify the calculation of Accumulated Total Cycles when the number of engine starts has not been recorded.	Feb 16, 2001
Table 1	Total Cycles increased for various Rotor Components.	Nov 22, 2001
Table 1	Post-SB24547 Third and Fourth-Stage LP Turbine Disks, 30A1853 and 30A1854, added to the PW305B Rotor Components, Service Life Table.	January 20, 2005
Table 1	Post SB24569 High Compressor Rotor part number 30B6531-01 added to Rotor Components - Service Life.	September 12, 2006
Table 1	Post SB24585 HP Rear Turbine Cover part number 30B6726-01 added to Rotor Components - Service Life.	June 14, 2007
Table 1	Impeller part number 30B2185, First-Stage Rotor - High Compressor part numbers 30B1859, 30B2175 and Post-SB24586 Disk - Turbine part number 30A1855 are added to Rotor Components - Service Life.	Sep 05, 2008

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TEMPORARY REVISION NO. AL-7

(PW305, PW305A, PW305B)

INSERT Temporary Revision AL-7 facing page 1, AIRWORTHINESS LIMITATIONS

AIRWORTHINESS LIMITATIONS

PURPOSE: The purpose of this Temporary Revision (TR) is to add the service life of the SB 24609 first-stage high compressor rotor P/N 30B6551-01. This TR also takes the opportunity to define what the acronym APR stands for.

A. General

(1) The engine rotating components listed in Table 1 are subject to low-cycle fatigue (LCF) due to cyclic operation of the engine. As a result, these parts must be replaced when the cycle limit is reached.

(2) Operators shall record all flights, starts and accumulated total cycles (which must be calculated) in the applicable document for each component.

NOTE: For the purpose of LCF life cycle calculation, a start is defined as an engine start followed by one or more flights. A flight is defined as a lift-off to touch down, irrespective of engine starts and stops.

(3) When starts are not recorded, each flight is considered to have been preceded by one engine start, ie. number of starts is equal to the number of flights.

(4) Rotor components must be removed from service when the "total cycle limit" is reached. Service life is calculated in accordance with the following formula:

$$\text{Accumulated Total Cycles} = \left[\text{No. of Starts} + \left(\frac{\text{No. of Flights - No. of Starts}}{\text{Abbreviated Cycle Factor}} \right) \right] \text{X Flight Count Factor}$$

(5) The service life values listed in Table 1 are incorporated in the Type Approval as issued by the Canadian Department of Transport. Changes to rotor component cyclic lives must be approved by Transport Canada.

(6) The specified cyclic lives apply to engines, modules and components which contain parts listed in the approved parts list, as shown in the applicable Illustrated Parts Catalog (IPC) and Service Bulletins (SB). Operators requesting approval to incorporate parts not listed in the applicable IPC or SB's will be required to substantiate the cyclic lives of these parts to their local airworthiness authority.

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(7) Operators making use of the APR (Automatic Power Reserve) setting to augment normal take-off must use the APR flight count factor each time the setting is used, as defined in Table 1. APR usage for one engine inoperative mode or when required for system testing in accordance with the airframe manufacturers recommendations allows the use of the normal take-off flight count factor.

NOTE: Scheduled use of the APR rating during take-off increases the flight count factor.

(8) Operators having missions which include many touch-and-go flights, or a frequency of scheduled in flight shut-downs, such as used in training missions; or which include more than 3 flights per hour; must define the engine re-lights as engine starts per equation in step 1 and submit their mission profiles to Pratt and Whitney Canada for life cycles analysis.

B. Service Life Marking Method

(1) At overhaul or major refurbishment all rotor components must be marked in accordance with the applicable Overhaul Manual, using the following codes:

(a) Total cycles must be marked using a CY prefix, as follows:

1 The total cycles accumulated between each shop visit, rounded to the nearest 100 cycles, must be marked with the last two digits dropped and followed by a dash (-).

2 Example: A part having cycles between visits of 525, 1819 and 1972 cycles would be marked as CY5-18-20- which equals approximately 4300 total cycles.

TABLE 1, Rotor Components - Service Life

Description	Part No.	Model	Flight Count Factor		Abbr'd Cycle Factor	Total Cycles
			Normal T.O.	APR T.O.		
Hub-Fan	30B1778	PW305A, PW305B	1	1.5	1.3	12000
	30B2256 SB24243	PW305A, PW305B	1	1.5	1.3	12000
Impeller	30B1830	PW305A, PW305B	1	1.5	1.4	1250
	30B1876 SB24087	PW305A, PW305B	1	1.5	1.4	5000
	30B2063 SB24089	PW305A, PW305B	1	1.5	1.4	5000
	30B2089 SB24159	PW305A, PW305B	1	1.5	1.4	5000

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TABLE 1, Rotor Components - Service Life (Cont'd)

Description	Part No.	Model	Flight Count Factor		Abbr'd Cycle Factor	Total Cycles
			Normal T.O.	APR T.O.		
	30B2185	PW305A, PW305B	1	1.5	1.4	12000
	30B2244 SB24146	PW305A, PW305B	1	1.5	1.4	5000
	30B2441 SB24230	PW305A, PW305B	1	1.5	1.4	5000
	30B2442 SB24230	PW305A, PW305B	1	1.5	1.4	5000
	30B2443 SB24263	PW305A, PW305B	1	1.5	1.4	5000
	30B2486 SB24263	PW305A, PW305B	1	1.5	1.4	12000
	30B2858-01 SB24425	PW305A, PW305B	1	1.5	1.4	12000
	30B4565-01 SB24469	PW305A, PW305B	1	1.5	1.4	8500
Rotor - High Compressor (1st-stage)	30B1652	PW305A, PW305B	1	1.5	1.4	12000
	30B2096 SB24137	PW305A, PW305B	1	1.5	1.4	12000
	30B2260 SB24251	PW305A, PW305B	1	1.5	1.4	12000
	30B2799-01 SB24425	PW305A, PW305B	1	1.5	1.4	12000
	30B6531-01 SB24569	PW305A	1	1.5	1.4	12000
	30B6551-01 SB24609	PW305A	1	1.5	1.4	3500
(2nd-, 3rd- and 4th-stage)	30B1765 SB24026	PW305A, PW305B	1	1.5	1.4	5000
	30B1777	PW305A, PW305B	1	1.5	1.4	5000
	30B1859	PW305A, PW305B	1	1.5	1.4	5000

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TABLE 1, Rotor Components - Service Life (Cont'd)

Description	Part No.	Model	Flight Count Factor		Abbr'd Cycle Factor	Total Cycles
			Normal T.O.	APR T.O.		
	30B1868 SB24086	PW305A, PW305B	1	1.5	1.4	5000
	30B1917 SB24088	PW305A, PW305B	1	1.5	1.4	5000
	30B1925 SB24088	PW305A, PW305B	1	1.5	1.4	5000
	30B2015 SB24089	PW305A, PW305B	1	1.5	1.4	5000
	30B2019 SB24089	PW305A, PW305B	1	1.5	1.4	5000
	30B2091 SB24159	PW305A, PW305B	1	1.5	1.4	5000
	30B2092 SB24159	PW305A, PW305B	1	1.5	1.4	5000
	30B2175	PW305A, PW305B	1	1.5	1.4	5000
	30B2197 SB24154	PW305A, PW305B	1	1.5	1.4	8500
	30B2228 SB24128	PW305A, PW305B	1	1.5	1.4	5000
	30B2408 SB24128	PW305A, PW305B	1	1.5	1.4	5000
	30B2410 SB24128	PW305A, PW305B	1	1.5	1.4	5000
	30B2411 SB24128	PW305A, PW305B	1	1.5	1.4	5000
	30B2478 SB24287	PW305A, PW305B	1	1.5	1.4	5000
	30B2540 SB24295	PW305A, PW305B	1	1.5	1.4	8500
	30B2542 SB24295	PW305A, PW305B	1	1.5	1.4	5000
	30B2614 SB24128	PW305A, PW305B	1	1.5	1.4	5000

TABLE 1, Rotor Components - Service Life (Cont'd)

Description	Part No.	Model	Flight Count Factor		Abbr'd Cycle Factor	Total Cycles
			Normal T.O.	APR T.O.		
	30B2615 SB24128	PW305A, PW305B	1	1.5	1.4	5000
	30B2797-01 SB24425	PW305A, PW305B	1	1.5	1.4	8500
	30B4540-01 SB24464	PW305A, PW305B	1	1.5	1.4	8500
	30B4745-01 SB24477	PW305A, PW305B	1	1.5	1.4	8500
	31B6325-01 SB24376	PW305A, PW305B	1	1.5	1.4	8500
Disk - Turbine (1st-stage)	30B1852	PW305A, PW305B	1	1.5	2.0	3100
	30B2072 SB24115	PW305A, PW305B	1	1.5	2.0	3100
	30B2981-01 SB24425	PW305A, PW305B	1	1.5	2.0	3100
(2nd-stage)	30B1813	PW305A, PW305B	1	1.5	2.0	1250
	30B2200 SB24145	PW305A, PW305B	1	1.5	2.0	3300
	30B2912-01 SB24425	PW305A, PW305B	1	1.5	2.0	3300
(3rd-stage)	30A1102	PW305A, PW305B	1	1.5	1.0	7500
	30A1833 SB24454	PW305A, PW305B	1	1.5	1.0	7500
	30A1853 SB24547	PW305A, PW305B	1	1.5	1.0	7500
(4th-stage)	30A1457	PW305A, PW305B	1	1.5	1.0	4000
	30A1499 SB24041	PW305A, PW305B	1	1.5	1.0	4000
	30A1565 SB24164	PW305A, PW305B	1	1.5	1.0	7500

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TABLE 1, Rotor Components - Service Life (Cont'd)

Description	Part No.	Model	Flight Count Factor		Abbr'd Cycle Factor	Total Cycles
			Normal T.O.	APR T.O.		
	30A1834 SB24454	PW305A, PW305B	1	1.5	1.0	7500
	30A1854 SB24547	PW305A, PW305B	1	1.5	1.0	7500
(5th-stage)	30A1104	PW305A, PW305B	1	1.5	1.0	7500
	30A1835 SB24454	PW305A, PW305B	1	1.5	1.0	7500
	30A1855 SB24586	PW305A, PW305B	1	1.5	1.0	7500
Cover, HP Turbine, Rotor, Front	30B1308	PW305A, PW305B	1	1.5	1.0	1250
	30B2058 SB24063	PW305A, PW305B	1	1.5	1.0	4800
	30B2748-01 SB24425	PW305A, PW305B	1	1.5	1.0	4800
Cover, HP Turbine, Rear	30B1307	PW305A, PW305B	1	1.5	1.0	1250
	30B2057 SB24063	PW305A, PW305B	1	1.5	1.0	4400
	30B2747-01 SB24425	PW305A, PW305B	1	1.5	1.0	4400
	30B6726-01 SB24585	PW305A, PW305B	1.4	2.1	1.0	4400
Seal - Air, HP Turbine Rotor	30B1274	PW305A, PW305B	1	1.5	2.0	4000
	30B2055 SB24107	PW305A, PW305B	1	1.5	2.0	4000
	30B2499 SB24272	PW305A, PW305B	1	1.5	2.0	4000
	30B2500 SB24272	PW305A, PW305B	1	1.5	2.0	4000
	30B2552 SB24299	PW305A, PW305B	1	1.5	2.0	4000

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TABLE 1, Rotor Components - Service Life (Cont'd)

Description	Part No.	Model	Flight Count Factor		Abbr'd Cycle Factor	Total Cycles
			Normal T.O.	APR T.O.		
	30B2553 SB24299	PW305A, PW305B	1	1.5	2.0	4000
	30B2793-01 SB24425	PW305A, PW305B	1	1.5	2.0	4000

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AIRWORTHINESS LIMITATIONS

1. General

The Airworthiness Limitations section specifies mandatory Rotor Component Cyclic Life Limits and mandatory Scheduled Inspection/Maintenance Intervals required for type certification. The Airworthiness Limitations section is approved by Transport Canada.

2. Rotor Component Cyclic Life Limits

A. General

(1) The engine rotating components listed in Table 1 are subject to low-cycle fatigue (LCF) due to cyclic operation of the engine. As a result, these parts must be replaced when the cycle limit is reached.

(2) Operators shall record all flights, starts and accumulated total cycles (which must be calculated) in the applicable document for each component.

NOTE: For the purpose of LCF life cycle calculation, a start is defined as an engine start followed by one or more flights. A flight is defined as a lift-off to touch down, irrespective of engine starts and stops.

(3) When starts are not recorded, each flight is considered to have been preceded by one engine start, ie. number of starts is equal to the number of flights.

(4) Rotor components must be removed from service when the "total cycle limit" is reached. Service life is calculated in accordance with the following formula:

$$\text{Accumulated Total Cycles} = \left[\text{No. of Starts} + \left(\frac{\text{No. of Flights - No. of Starts}}{\text{Abbreviated Cycle Factor}} \right) \right] \text{X Flight Count Factor}$$

(5) The service life values listed in Table 1 are incorporated in the Type Approval as issued by the Canadian Department of Transport. Changes to rotor component cyclic lives must be approved by Transport Canada.

(6) The specified cyclic lives apply to engines, modules and components which contain parts listed in the approved parts list, as shown in the applicable Illustrated Parts Catalog (IPC) and Service Bulletins (SB). Operators requesting approval to incorporate parts not listed in the applicable IPC or SB's will be required to substantiate the cyclic lives of these parts to their local airworthiness authority.

(7) Operators making use of the APR setting to augment normal take-off must use the APR flight count factor each time the setting is used, as defined in Table 1. APR usage for one engine inoperative mode or when required for system testing in accordance with the airframe manufacturers recommendations allows the use of the normal take-off flight count factor.

NOTE: Scheduled use of the APR rating during take-off increases the flight count factor.

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(8) Operators having missions which include many touch-and-go flights, or a frequency of scheduled in flight shut-downs, such as used in training missions; or which include more than 3 flights per hour; must define the engine re-lights as engine starts per equation in step (4) and submit their mission profiles to Pratt and Whitney Canada for life cycles analysis.

B. Service Life Marking Method

(1) At overhaul or major refurbishment all rotor components must be marked in accordance with the applicable Overhaul Manual, using the following codes:

(a) Total cycles must be marked using a CY prefix, as follows:

1 The total cycles accumulated between each shop visit, rounded to the nearest 100 cycles, must be marked with the last two digits dropped and followed by a dash (-).

2 Example: A part having cycles between visits of 525, 1819 and 1972 cycles would be marked as CY5-18-20- which equals approximately 4300 total cycles.

TABLE 1, Rotor Components - Service Life

Description	Part No.	Model	Flight Count Factor		Abbr'd Cycle Factor	Total Cycles
			Normal T.O.	APR T.O.		
Hub-Fan	30B1778	PW305A, PW305B	1	1.5	1.3	12000
	30B2256 SB24243	PW305A, PW305B	1	1.5	1.3	12000
Impeller	30B1830	PW305A, PW305B	1	1.5	1.4	1250
	30B1876 SB24087	PW305A, PW305B	1	1.5	1.4	5000
	30B2063 SB24089	PW305A, PW305B	1	1.5	1.4	5000
	30B2089 SB24159	PW305A, PW305B	1	1.5	1.4	5000
	30B2185	PW305A, PW305B	1	1.5	1.4	12000
	30B2244 SB24146	PW305A, PW305B	1	1.5	1.4	5000
	30B2441 SB24230	PW305A, PW305B	1	1.5	1.4	5000

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TABLE 1, Rotor Components - Service Life (Cont'd)

Description	Part No.	Model	Flight Count Factor		Abbr'd Cycle Factor	Total Cycles
			Normal T.O.	APR T.O.		
	30B2442 SB24230	PW305A, PW305B	1	1.5	1.4	5000
	30B2443 SB24263	PW305A, PW305B	1	1.5	1.4	5000
	30B2486 SB24263	PW305A, PW305B	1	1.5	1.4	12000
	30B2858-01 SB24425	PW305A, PW305B	1	1.5	1.4	12000
	30B4565-01 SB24469	PW305A, PW305B	1	1.5	1.4	8500
Rotor - High Compressor (1st-stage)	30B1652	PW305A, PW305B	1	1.5	1.4	12000
	30B2096 SB24137	PW305A, PW305B	1	1.5	1.4	12000
	30B2260 SB24251	PW305A, PW305B	1	1.5	1.4	12000
	30B2799-01 SB24425	PW305A, PW305B	1	1.5	1.4	12000
	30B6531-01 SB24569	PW305A	1	1.5	1.4	12000
(2nd-, 3rd- and 4th-stage)	30B1765 SB24026	PW305A, PW305B	1	1.5	1.4	5000
	30B1777	PW305A, PW305B	1	1.5	1.4	5000
	30B1859	PW305A, PW305B	1	1.5	1.4	5000
	30B1868 SB24086	PW305A, PW305B	1	1.5	1.4	5000
	30B1917 SB24088	PW305A, PW305B	1	1.5	1.4	5000
	30B1925 SB24088	PW305A, PW305B	1	1.5	1.4	5000
	30B2015 SB24089	PW305A, PW305B	1	1.5	1.4	5000

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TABLE 1, Rotor Components - Service Life (Cont'd)

Description	Part No.	Model	Flight Count Factor		Abbr'd Cycle Factor	Total Cycles
			Normal T.O.	APR T.O.		
	30B2019 SB24089	PW305A, PW305B	1	1.5	1.4	5000
	30B2091 SB24159	PW305A, PW305B	1	1.5	1.4	5000
	30B2092 SB24159	PW305A, PW305B	1	1.5	1.4	5000
	30B2175	PW305A, PW305B	1	1.5	1.4	5000
	30B2197 SB24154	PW305A, PW305B	1	1.5	1.4	8500
	30B2228 SB24128	PW305A, PW305B	1	1.5	1.4	5000
	30B2408 SB24128	PW305A, PW305B	1	1.5	1.4	5000
	30B2410 SB24128	PW305A, PW305B	1	1.5	1.4	5000
	30B2411 SB24128	PW305A, PW305B	1	1.5	1.4	5000
	30B2478 SB24287	PW305A, PW305B	1	1.5	1.4	5000
	30B2540 SB24295	PW305A, PW305B	1	1.5	1.4	8500
	30B2542 SB24295	PW305A, PW305B	1	1.5	1.4	5000
	30B2614 SB24128	PW305A, PW305B	1	1.5	1.4	5000
	30B2615 SB24128	PW305A, PW305B	1	1.5	1.4	5000
	30B2797-01 SB24425	PW305A, PW305B	1	1.5	1.4	8500
	30B4540-01 SB24464	PW305A, PW305B	1	1.5	1.4	8500
	30B4745-01 SB24477	PW305A, PW305B	1	1.5	1.4	8500

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TABLE 1, Rotor Components - Service Life (Cont'd)

Description	Part No.	Model	Flight Count Factor		Abbr'd Cycle Factor	Total Cycles
			Normal T.O.	APR T.O.		
	31B6325-01 SB24376	PW305A, PW305B	1	1.5	1.4	8500
Disk - Turbine (1st-stage)	30B1852	PW305A, PW305B	1	1.5	2.0	3100
	30B2072 SB24115	PW305A, PW305B	1	1.5	2.0	3100
	30B2981-01 SB24425	PW305A, PW305B	1	1.5	2.0	3100
(2nd-stage)	30B1813	PW305A, PW305B	1	1.5	2.0	1250
	30B2200 SB24145	PW305A, PW305B	1	1.5	2.0	3300
	30B2912-01 SB24425	PW305A, PW305B	1	1.5	2.0	3300
(3rd-stage)	30A1102	PW305A, PW305B	1	1.5	1.0	7500
	30A1833 SB24454	PW305A, PW305B	1	1.5	1.0	7500
	30A1853 SB24547	PW305A, PW305B	1	1.5	1.0	7500
(4th-stage)	30A1457	PW305A, PW305B	1	1.5	1.0	4000
	30A1499 SB24041	PW305A, PW305B	1	1.5	1.0	4000
	30A1565 SB24164	PW305A, PW305B	1	1.5	1.0	7500
	30A1834 SB24454	PW305A, PW305B	1	1.5	1.0	7500
	30A1854 SB24547	PW305A, PW305B	1	1.5	1.0	7500
(5th-stage)	30A1104	PW305A, PW305B	1	1.5	1.0	7500
	30A1835 SB24454	PW305A, PW305B	1	1.5	1.0	7500

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TABLE 1, Rotor Components - Service Life (Cont'd)

Description	Part No.	Model	Flight Count Factor		Abbr'd Cycle Factor	Total Cycles
			Normal T.O.	APR T.O.		
	30A1855 SB24586	PW305A, PW305B	1	1.5	1.0	7500
Cover, HP Turbine, Rotor, Front	30B1308	PW305A, PW305B	1	1.5	1.0	1250
	30B2058 SB24063	PW305A, PW305B	1	1.5	1.0	4800
	30B2748-01 SB24425	PW305A, PW305B	1	1.5	1.0	4800
Cover, HP Turbine, Rear	30B1307	PW305A, PW305B	1	1.5	1.0	1250
	30B2057 SB24063	PW305A, PW305B	1	1.5	1.0	4400
	30B2747-01 SB24425	PW305A, PW305B	1	1.5	1.0	4400
	30B6726-01 SB24585	PW305A, PW305B	1.4	2.1	1.0	4400
Seal - Air, HP Turbine Rotor	30B1274	PW305A, PW305B	1	1.5	2.0	4000
	30B2055 SB24107	PW305A, PW305B	1	1.5	2.0	4000
	30B2499 SB24272	PW305A, PW305B	1	1.5	2.0	4000
	30B2500 SB24272	PW305A, PW305B	1	1.5	2.0	4000
	30B2552 SB24299	PW305A, PW305B	1	1.5	2.0	4000
	30B2553 SB24299	PW305A, PW305B	1	1.5	2.0	4000
	30B2793-01 SB24425	PW305A, PW305B	1	1.5	2.0	4000

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CHAPTER

05

TIME LIMITS/ MAINTENANCE CHECKS

TABLE OF CONTENTS

SUBJECT	PAGE
TIME LIMITS / MAINTENANCE CHECKS	**05-00-00**
1. General	1
2. Maintenance Philosophy	1

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Sep 06/2002
	2 blank	Sep 06/2002
Contents	1	Sep 06/2002
	2 blank	Sep 06/2002
05-00-00 Time Limits	1	Sep 06/2002
	2 blank	Sep 06/2002

TIME LIMITS / MAINTENANCE CHECKS

1. General

The Rotor Component Cyclic Life Limits (Ref. Airworthiness Limitations) contain mandatory rotor component cyclic life limits which are a condition of engine type certification. These limits and procedures are approved by Transport Canada.

The Operating Limits and Leading Particulars section (Chapter 5-10-00) contain limits approved by Transport Canada.

The Scheduled Inspection/Maintenance Intervals section (Chapter 5-20-00) consists of periodic inspections, maintenance tasks, frequencies and overhaul life limits which have been accepted by Transport Canada. DELETED.

The Unscheduled Maintenance Inspections section (Chapter 5-50-00) consists of inspections and actions required when an engine exceeds the operating limitations (Ref. 5-10-00) or is subjected to unusual stress or operating conditions or gives unsatisfactory performance.

2. Maintenance Philosophy

Pratt & Whitney Canada will pursue an "On-condition" philosophy for the PW305, PW305A and PW305B engines.

"On-condition" maintenance requires that the condition of the engine be monitored/evaluated regularly to demonstrate continued airworthiness to the satisfaction of the regulatory agencies. P&WC will provide recommendations for a continuous maintenance program which will help operators achieve an on-condition status for the PW305, PW305A and PW305B engines.

Recommended procedures will include:

Engine condition and trend monitoring.
Periodic inspections of critical areas, both internal and external, by the operator and P&WC.
Analysis of oil filter and chip detector residues.

Using the above techniques, the optimum economic refurbishment intervals for a fleet operator can be established.

During the period to maturity the engine will be subject to a sampling program. Details are to be agreed with the regulatory authorities but the program will be in the form of inspections of a number of engines at the prevalent maintenance intervals. Inspection of hardware made available through premature engine removals will be incorporated in the sampling program as appropriate for any given event.

TABLE OF CONTENTS

SUBJECT	PAGE
OPERATING LIMITS AND LEADING PARTICULARS	**05-10-00**
1. General	1
2. Operating Limits and Leading Particulars	1
A. Operating Limits	1
B. Overspeed Limits	1
C. Overtemperature Limits	1
D. Leading Particulars	1

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Sep 12/2008
	2 blank	Sep 12/2008
Contents	1	Sep 12/2008
	2 blank	Sep 12/2008
05-10-00	1	Sep 12/2008
Operating Limits	2	Sep 12/2008
and Leading	3	Sep 12/2008
Particulars	4	Sep 12/2008
	5	Sep 12/2008
	6	Sep 12/2008
	7	Sep 12/2008
	8	Sep 12/2008
	9	Sep 12/2008
	10	Sep 12/2008
	11	Sep 12/2008
	12 blank	Sep 12/2008

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OPERATING LIMITS AND LEADING PARTICULARS

1. General

The Operating Limits and Leading Particulars section lists operating limits, overspeed limits, overtemperature limits and leading particulars for PW305, PW305A and PW305B engines.

Refer to Chapter 72-00-00 for the listing of approved oils.

Refer to Chapter 72-00-00 for the listing of approved fuels.

2. Operating Limits and Leading Particulars

A. Operating Limits

(1) Engine operating limits for the PW305 and PW305B engines are detailed in Table 1.

(2) Engine operating limits for the PW305A engine are detailed in Table 2.

B. Overspeed Limits

(1) Overspeed limits for the PW305, PW305A and PW305B engines for the HP and LP rotors are detailed in Figure 1.

C. Overtemperature Limits

(1) Overtemperature limits for the PW305 and PW305B engines are detailed in Figures 2 and 3.

(2) Overtemperature limits for the PW305A engine are detailed in Figures 4 and 5.

D. Leading Particulars

(1) Engine thrust, specifications and leading particulars for the PW305 engine are detailed in Table 3 and Table 6 respectively.

(2) Engine thrust, specifications and leading particulars for the PW305A engine are detailed in Table 4 and Table 6 respectively.

(3) Engine thrust, specifications and leading particulars for the PW305B engine are detailed in Table 5 and Table 6 respectively.

TABLE 1, PW305 and PW305B Engines Operating Limits

Thrust Setting	Time Limit (Minutes)	Max ITT (T4.5°C)	N2		N1		Oil Press. PSIG (Note 5)	Oil Temp. (°C)
			RPM	%	RPM	%		
Maximum Take-off	5 (Note 3)	785	27469	102	10820	102	80 Max 36 Min	135 Max 10 Min

TABLE 1, PW305 and PW305B Engines Operating Limits (Cont'd)

Thrust Setting	Time Limit (Minutes)	Max ITT (T4.5°C)	N2 RPM	N2 %	N1 RPM	N1 %	Oil Press. PSIG (Note 5)	Oil Temp. (°C)
Normal Take-off	5 (Note 4)	760	27146	100.8	10820	102	80 Max 36 Min	135 Max 10 Min
Maximum Continuous (Note 6)	Continuous	785	27469	102	10820	102	80 Max 36 Min	135 Max 10 Min
Maximum Cruise (Note 6)	Continuous	785	27469	102	10820	102	80 Max 36 Min	135 Max 10 Min
Reverse Thrust (Note 7)	5	785	-	-	10400	98	80 Max 36 Min	135 Max 10 Min
Flight Idle	Continuous		17500 (Note 8)	65	-	-	80 Max 20 Min	135 Max 10 Min
Ground Idle	Continuous	-	15350 (Note 8)	57	-	-	80 Max 20 Min	135 Max 10 Min
Starting	-	680 (Fig. 2)	-	-	-	-	220 Max 20 Min	-40 Min
Transient	20 sec	795 (Fig. 3)	28007	104	11032	104	220 Max 0 Min	143 Max 135 Min
	90 sec						220 Max 10 Min	143 Max 135 Min

NOTE: 1. DELETED

NOTE: 2. DELETED

NOTE: 3. The total time during which maximum takeoff thrust may be used is limited to five minutes; the time to commence with increase in LP Rotor (N1) speed or with advance of thrust lever angle to the takeoff detent. Refer to CAUTION at end of table.

NOTE: 4. The total time during which normal takeoff thrust may be used is limited to five minutes; the time limit to commence with advance of thrust lever angle to the takeoff detent. Refer to CAUTION at end of table.

NOTE: 5. Normal oil pressure is 36 to 80 psi at engine speeds above 45% N2, oil pressure will vary within these values depending on oil temperature. Oil pressure below 36 psi is undesirable and should be tolerated only for the completion of the flight, preferably at reduced power setting to ensure oil temperature does not exceed limits. Oil pressure below 20 psi is unsafe and requires the engine be shut down.

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TABLE 1, PW305 and PW305B Engines Operating Limits (Cont'd)

Thrust Setting	Time Limit (Minutes)	Max ITT (T4.5°C)	N2 RPM	N2 %	N1 RPM	N1 %	Oil Press. PSIG (Note 5)	Oil Temp. (°C)

NOTE: 6. Climb and Cruise Power Setting
The values for engine fan (N1) speed to be used during climb and cruise operations is determined from the appropriate flight thrust settings furnished by the aircraft manufacturer for any given aircraft/engine combination, in accordance with the operating limits.
Selection of climb or cruise thrust setting is made by positioning the Thrust Lever Angle in the appropriate lever detent, or alternative retarded position if required.

NOTE: 7. Reverse thrust is defined as maximum mechanical N1. Thrust levels above this can be used, however, operation above this level will increase engine life cycle counts.

NOTE: 8. The minimum idle speeds shown are mechanical speeds.

CAUTION: IF THE FIVE MINUTE LIMIT IS EXCEEDED, RECORD THE EVENT AND TOTAL TIME IN THE ENGINE LOG BOOK. IF CUMMULATIVE TIME EXCEEDS ONE HOUR, DO AN ENGINE HOT SECTION BORESCOPE INSPECTION.

TABLE 2, PW305A Engine Operating Limits

Thrust Setting	Time Limit (Minutes)	Max. Trimmed ITT (T4.5°C)	N2 RPM	N2 %	N1 RPM	N1 %	Oil Press. PSIG (Note 5)	Oil Temp. (°C)
Maximum Take-off	5 (Note 3)	785	27469	102	10820	102	80 Max 36 Min	135 Max 10 Min
Normal Take-off	5 (Note 4)	760	27146	100.8	10820	102	80 Max 36 Min	135 Max 10 Min
Maximum Continuous (Note 6)	Continuous	785	27469	102	10820	102	80 Max 36 Min	135 Max 10 Min
Maximum Cruise (Note 6)	Continuous	785	27469	102	10820	102	80 Max 36 Min	135 Max 10 Min
Reverse Thrust (Note 7)	5	785	-	-	10400	98	80 Max 36 Min	135 Max 10 Min
Flight Idle	Continuous		17500 (Note 8)	65	-	-	80 Max 20 Min	135 Max 10 Min
Ground Idle	Continuous	-	14004 (Note 8)	52	-	-	80 Max 20 Min	135 Max 10 Min

TABLE 2, PW305A Engine Operating Limits (Cont'd)

Thrust Setting	Time Limit (Minutes)	Max. Trimmed ITT (T4.5°C)	N2		N1		Oil Press. PSIG (Note 5)	Oil Temp. (°C)
			RPM	%	RPM	%		
Starting	-	950 (Fig. 4)	-	-	-	-	220 Max 20 Min	-40 Min
Transient	20 sec	825 (Fig. 5)	28007	104	11032	104	220 Max 0 Min	143 Max 135 Min
	90 sec						220 Max 10 Min	143 Max 135 Min

NOTE: 1. DELETED

NOTE: 2. DELETED

NOTE: 3. The total time during which maximum takeoff thrust may be used is limited to five minutes; the time to commence with increase in LP Rotor (N1) speed or with advance of thrust lever angle to the takeoff detent. Refer to CAUTION at end of table.

NOTE: 4. The total time during which normal takeoff thrust may be used is limited to five minutes; the time limit to commence with advance of thrust lever angle to the takeoff detent. Refer to CAUTION at end of table.

NOTE: 5. Normal oil pressure is 36 to 80 psi at engine speeds above 45% N2, oil pressure will vary within these values depending on oil temperature. Oil pressure below 36 psi is undesirable and should be tolerated only for the completion of the flight, preferably at reduced power setting to ensure oil temperature does not exceed limits. Oil pressure below 20 psi is unsafe and requires the engine be shut down.

NOTE: 6. Climb and Cruise Power Setting
The values for engine fan (N1) speed to be used during climb and cruise operations is determined from the appropriate flight thrust settings furnished by the aircraft manufacturer for any given aircraft/engine combination, in accordance with the operating limits. Selection of climb or cruise thrust setting is made by positioning the Thrust Lever Angle in the appropriate lever detent, or alternative retarded position if required.

NOTE: 7. Reverse thrust is defined as maximum mechanical N1. Thrust levels above this can be used, however, operation above this level will increase engine life cycle counts.

NOTE: 8. The minimum idle speeds shown are mechanical speeds.

CAUTION: IF THE FIVE MINUTE LIMIT IS EXCEEDED, RECORD THE EVENT AND TOTAL TIME IN THE ENGINE LOG BOOK. IF CUMMULATIVE TIME EXCEEDS ONE HOUR, DO AN ENGINE HOT SECTION BORESCOPE INSPECTION.

TABLE 3, PW305 Engine Thrust (Uninstalled)

Rating (5)	Net Thrust (LBS)
Max. Take-off (1)	5225

TABLE 3, PW305 Engine Thrust (Uninstalled) (Cont'd)

Rating (5)	Net Thrust (LBS)
Normal Take-off (2)	5225
Max. Continuous (3)	4750
Max. Cruise (4)	4725

(1) Available to 22°C.

(2) Available to 15°C.

(3) Available to 19.4°C.

(4) Available to 15°C.

(5) The APR system in the EEC will increase the engine thrust from NORMAL TAKE-OFF to MAXIMUM TAKE-OFF, or from Maximum Continuous/Maximum Climb (MCT) to MCT x 1.11 in the event that the other engine experiences a substantial loss of thrust.

TABLE 4, PW305A Engine Thrust (Uninstalled)

Rating (5)	Net Thrust (LBS)
Max. Take-off (1)	4679
Normal Take-off (2)	4679
Max. Continuous (3)	4679
Max. Cruise (4)	4679

(1) Available to 33.9°C.

(2) Available to 26.6°C.

(3) Available to 20.8°C.

(4) Available to 16°C.

(5) The APR system in the EEC will increase the engine thrust from NORMAL TAKE-OFF to MAXIMUM TAKE-OFF, or from Maximum Continuous/Maximum Climb (MCT) to MCT x 1.11 in the event that the other engine experiences a substantial loss of thrust.

TABLE 5, PW305B Engine Thrust (Uninstalled)

Rating (5)	Net Thrust (LBS)
Max. Take-off (1)	5266
Normal Take-off (2)	5204
Max. Continuous (3)	4483
Max. Cruise (4)	4460

TABLE 5, PW305B Engine Thrust (Uninstalled) (Cont'd)

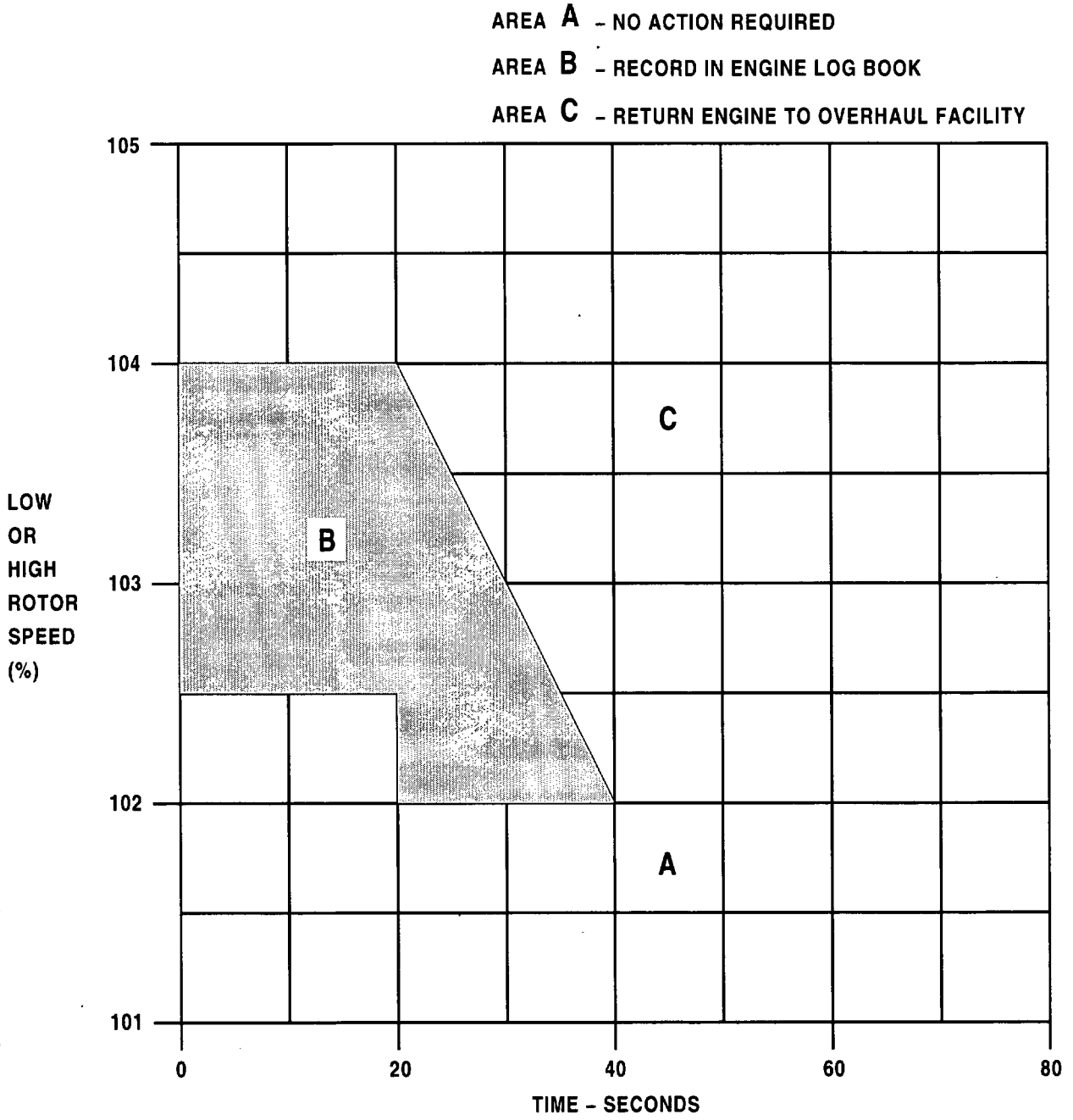
Rating (5)	Net Thrust (LBS)
(1) Available to 23.5°C.	
(2) Available at 15°C.	
(3) Available to 27.5°C.	
(4) Available to 15°C.	
(5) The APR system in the EEC will increase the engine thrust from NORMAL TAKE-OFF to MAXIMUM TAKE-OFF, or from Maximum Continuous/Maximum Climb (MCT) to MCT x 1.11 in the event that the other engine experiences a substantial loss of thrust.	

TABLE 6, PW305/305A/305B Engine Specifications and Leading Particulars (Uninstalled)

Engine Type	Turbofan
Type of Combustion Chamber	Annular
Fan Rotation (Looking Forward)	Clockwise
Engine Diameter (Inlet)	34.2 in. (86.9 cm)
Engine Diameter (Overall)	36.5 in. (92.7 cm)
Engine Length (Basic at Room Temperature)	81.4 in. (206.8 cm)
Oil Consumption, Maximum (Over 10 Hours Period)	5 lbs (2.3 kg) or (2.3 litres) (0.6 U.S. gal.)
Maximum Dry Weight (Basic Engine Without Options)	992.9 lbs (450.4 kg)
Weight of Oil at Max. Level and Residual Fuel	26.3 lbs (11.9 kg)
Oil Tank Capacity	2.11 US Gal. (8.0 l)
Usable Oil Capacity	1.25 US Gal. (4.73 l)

TABLE 7, PW305/305A/305B Oil and Fuel Leakage Rates

Component	Permitted Leakage Rate
Oil Drains	2 cc/hr (each drain)
IGV Actuator	10 drops/minute
Fuel Waste Ejector	None Permitted



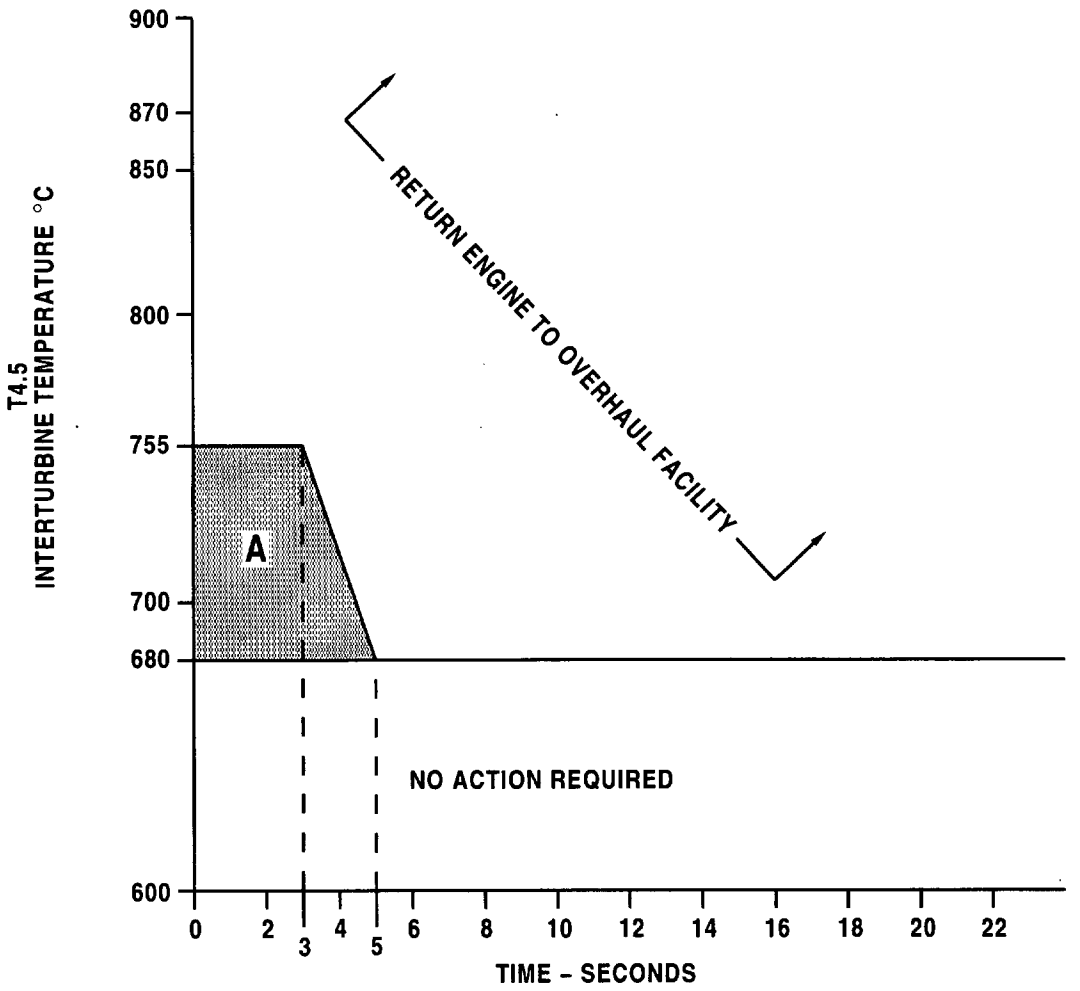
C32180

PW305/PW305A/PW305B HP and LP Rotor Overspeed Limits
Figure 1

PW305/PW305B

INTERTURBINE TEMPERATURES SHOWN MAKE NO ALLOWANCE FOR CORRECTION FACTORS OR INSTRUMENT ERRORS BUT DO ALLOW FOR SOME TYPICAL INSTRUMENT LAG.

AREA A (1) DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE
(2) PERFORM VISUAL INSPECTION
(3) RECORD IN ENGINE LOG BOOK

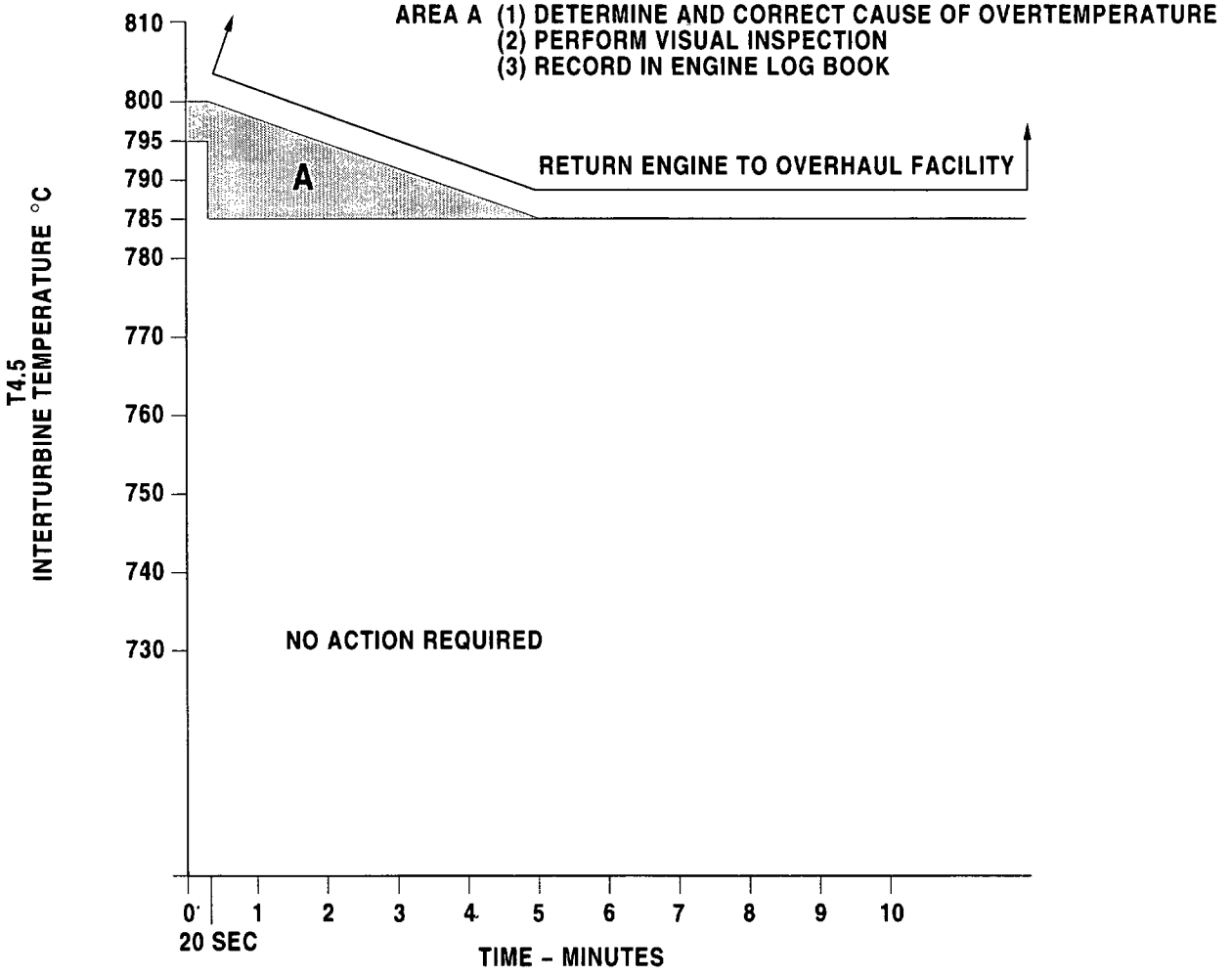


C32193C

PW305/PW305B Overtemperature Limits - Starting Conditions Only
Figure 2

PW305/PW305B

INTERTURBINE TEMPERATURES SHOWN MAKE NO ALLOWANCE FOR CORRECTION FACTORS OR INSTRUMENT ERRORS BUT DO ALLOW FOR SOME TYPICAL INSTRUMENT LAG.



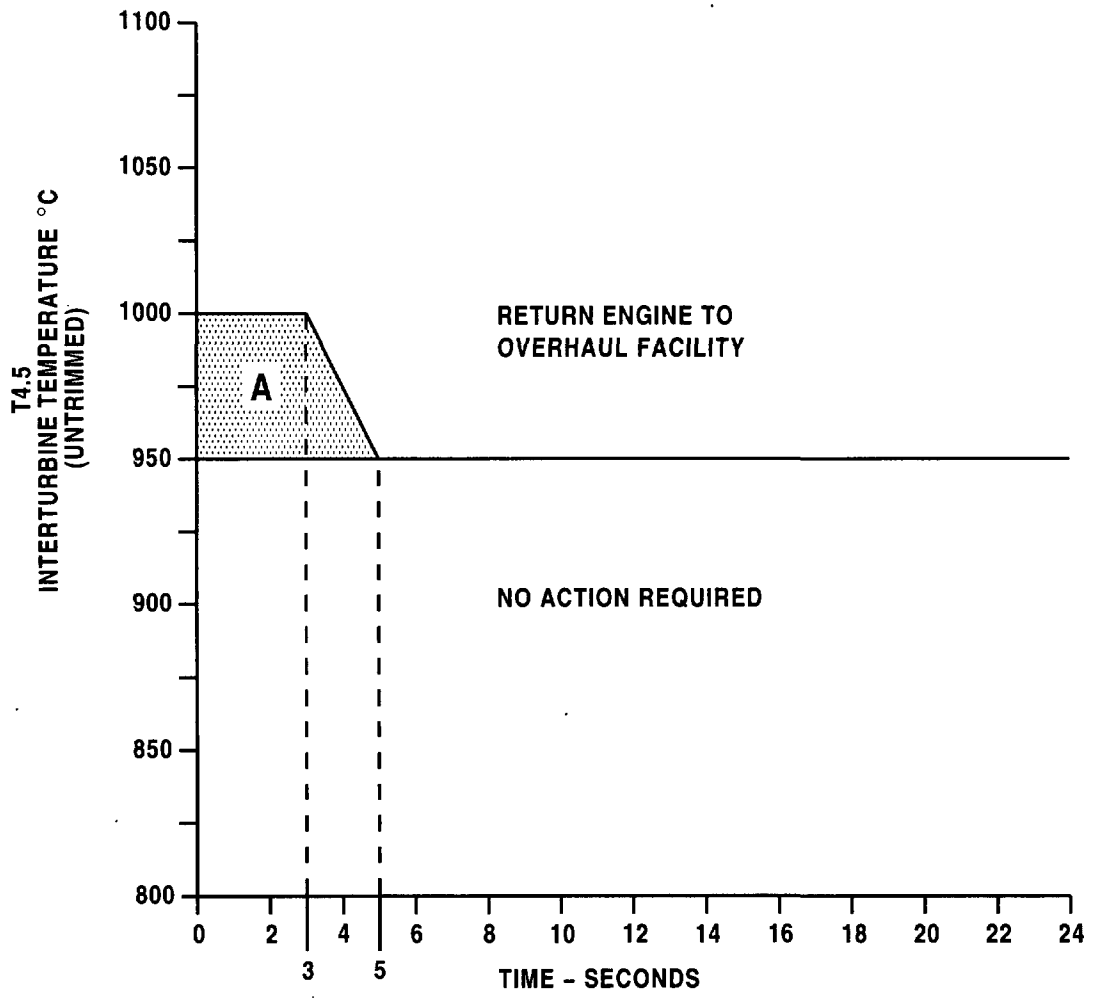
C32179C

PW305/PW305B Overtemperature Limits - All Conditions Except Starting
Figure 3

PW305A

INTERTURBINE TEMPERATURES SHOWN MAKE NO ALLOWANCE FOR CORRECTION FACTORS OR INSTRUMENT ERRORS BUT DO ALLOW FOR SOME TYPICAL INSTRUMENT LAG.

AREA A (1) DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE
(2) PERFORM VISUAL INSPECTION
(3) RECORD IN ENGINE LOG BOOK



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PW305A Overtemperature Limits - Starting Conditions Only
Figure 4

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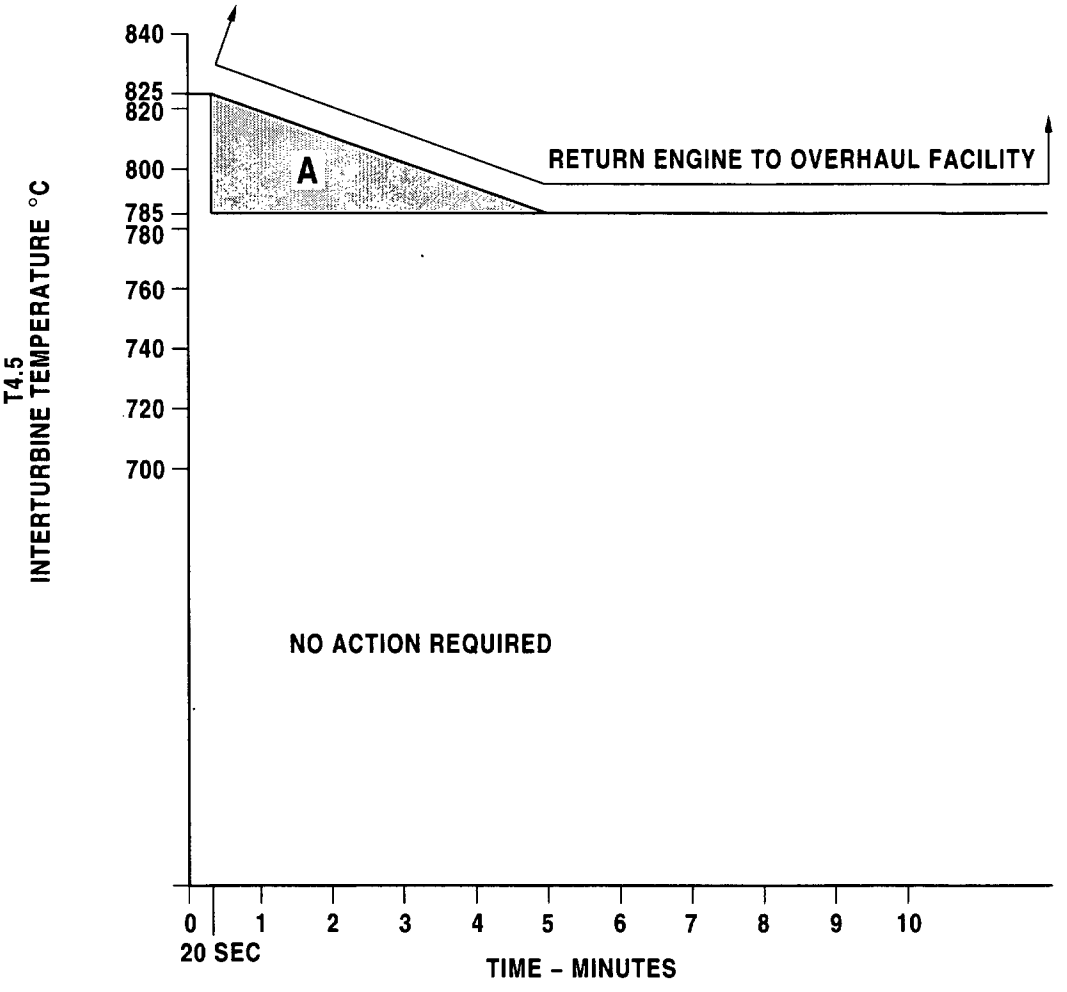
PW305A

INTERTURBINE TEMPERATURES SHOWN MAKE NO ALLOWANCE FOR CORRECTION FACTORS OR INSTRUMENT ERRORS BUT DO ALLOW FOR SOME TYPICAL INSTRUMENT LAG.

AREA A (1) DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE
(2) PERFORM VISUAL INSPECTION OF HOT SECTION USING BORESCOPE
(3) RECORD IN ENGINE LOG BOOK



C33040B

PW305A Overtemperature Limits - All Conditions Except Starting
Figure 5

TABLE OF CONTENTS

SUBJECT	PAGE
SCHEDULED MAINTENANCE CHECKS	**05-20-00**
1. General	1
2. Baseline TBO and HSI Frequency	1
A. Baseline TBO	1
B. Baseline HSI	1
C. ECTM Borescope Inspection	2
D. Rotor Component Life	2
3. Extended TBO and HSI Frequency	2
A. Extended TBO - 6000 Hours	2
B. Extended HSI - 3000 Hours	3
C. Extended TBO - 7200 Hours	3
D. Extended HSI - 3600 Hours	4
E. Rotor Component Life	4
4. Engine Accessories	4
5. TBO Extension Program	5
6. Engine Externals and Compressor Wash	5
7. Low Utilization Engine Inspection Program	7
8. Periodic Inspections	8

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Sep 12/2008
	2 blank	Sep 12/2008
Contents	1	Sep 12/2008
	2 blank	Sep 12/2008
05-20-00	1	Sep 12/2008
Scheduled	2	Sep 12/2008
Maintenance	3	Sep 12/2008
Checks	4	Sep 12/2008
	5	Sep 12/2008
	6	Sep 12/2008
	7	Sep 12/2008
	8	Sep 12/2008
	9	Sep 12/2008
	10	Sep 12/2008
	11	Sep 12/2008
	12	Sep 12/2008
	13	Sep 12/2008
	14	Sep 12/2008
	15	Sep 12/2008
	16	Sep 12/2008
	17	Sep 12/2008
	18	Sep 12/2008

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SCHEDULED MAINTENANCE CHECKS

1. General

   A. The Scheduled Maintenance Checks section contains:

   - a suggested generic operating "baseline" and "extended" Engine Operating Time Between Overhaul (TBO).
   - a suggested generic Hot Section Inspection (HSI) frequency.
   - Periodic Inspection criteria and frequency.

   B. The inspection and restoration intervals provided herein are the manufacturer's recommendations.

   C. Under extreme conditions of very low utilization, coupled with continuous operation in salt water atmosphere, or heavy sand and dust environment, periodic inspection in accordance with the applicable instructions detailed in this section may indicate maintenance action prior to the recommended interval.

   D. The inspection procedures detailed are considered a normal function of operating organizations and are intended as a guide for minimum inspection and maintenance requirements. With the exception of those routine inspections that coincide with airframe DAILY or PREFLIGHT checks, MINOR is normally coincidental with the scheduled airframe inspection checks which occur at 100 through to 360 hour intervals, from the time of last inspection, depending on the aircraft. The intervals at which these inspections are performed are based upon the nature and condition of engine operation. Engines operating in sandy or dusty environments or in smog or salt-laden atmospheres should be subjected to regular inspections for corrosion and fan blade erosion.

   E. Rotor component life limitations as outlined in the AIRWORTHINESS LIMITATIONS section of this manual override TBO consideration.

   F. The recommended HSI frequency for all PW305, PW305A and PW305B engines not incorporating SB24419 (second-stage vane) and SB24365 (combustion chamber liner) is 2250 hours, plus or minus 50 hours.

2. Baseline TBO and HSI Frequency

   A. Baseline TBO

   The recommended TBO interval for all PW305, PW305A and PW305B engines is 5000 hours, plus 100 hours. The additional 100 hours is for scheduling purposes.

   B. Baseline HSI

   The recommended HSI frequency for all PW305, PW305A and PW305B engines incorporating SB24419 (second-stage vane) and SB24365 (combustion chamber liner) is 2500 hours, plus or minus 250 hours.

The recommended HSI frequency for all PW305, PW305A and PW305B engines not incorporating SB24419 (second-stage vane) and SB24365 (combustion chamber liner) is 2250 hours, plus or minus 50 hours.

For engines not incorporating SB24419 (second-stage vane) and not having accomplished prior HSI, remove the second-stage vane as described above.

For engines not incorporating SB24419 (second-stage vane) and having accomplished prior HSI or second-stage vane inspection, remove the vane within 2250 hours since new, replacement or inspection.

For engines not incorporating SB24365 (combustion chamber liner), replace the combustion chamber liner coincidental with the incorporation of SB24419 (second-stage vane).

C. ECTM Borescope Inspection

Applicable to engines that are Post-SB24419 (second-stage vane) and SB24365 (combustion chamber liner).
Alternatively, the first HSI interval may be based on Engine Condition Trend Monitoring (ECTM). If ECTM is used, the hot section shall be borescope inspected to include all of the items in TABLE 1, Periodic Inspection, Item 10, ECTM Borescope Workscope at the intervals specified therein.

D. Rotor Component Life

Rotor component life limitations as outlined in the AIRWORTHINESS LIMITATIONS section of this manual override TBO consideration.

3. Extended TBO and HSI Frequency

A. Extended TBO - 6000 Hours

Applicable to all PW305, PW305A and PW305B engines which have had the following SBs or superseding ones incorporated:

- SB24365 (Combustion Chamber Liner)
- SB24419 (Second-Stage Vane)
- SB24428 (No. 1 Bearing)
- SB24437 (Fuel Nozzles)
- SB24458 (Intershaft Seal Housing)
- SB24459 (Preformed Packing for Intershaft Seal Housing)
- SB24460 (Intershaft Carbon Seals)

The recommended TBO interval is 6000 hours, plus 100 hours. The additional 100 hours is for scheduling purposes.

Operators who wish to use the extended TBO program may do so provided:

- The rotor component life limitations as outlined in the AIRWORTHINESS LIMITATIONS section of this manual is not exceeded.
- Only Post-SB24419 Vanes are used after 5000 hours.
- Prior to 5000 hours Pre-SB24419 vanes are subject to replacement per the Periodic Inspection Table.
- The above listed SBs are incorporated before the engine reaches 5000 hours.

B. Extended HSI - 3000 Hours

The recommended HSI interval is 3000 hours, plus 100 hours. The additional 100 hours is for scheduling purposes. Refer to TABLE 1, Periodic Inspection for maintenance interval.

Operators who wish to use the extended HSI program may do so provided:

- The rotor component life limitations, as outlined in the AIRWORTHINESS LIMITATIONS section of this manual, are not exceeded.
- The above listed SBs are incorporated before the HPT components reach 2500 hours.

C. Extended TBO - 7200 Hours

(1) Applicable to all PW305, PW305A and PW305B engines which have had the following SBs or superseding ones incorporated.

(2) The below listed SBs are incorporated before the engine reaches 5000 hours.

- SB24419 (Second-Stage Vane)
- SB24428 (No. 1 Bearing)
- SB24437 (Fuel Nozzles)
- SB24458 (Intershaft Seal Housing)
- SB24459 (Preformed Packing for Intershaft Seal Housing)
- SB24460 (Intershaft Carbon Seals)

(3) The below listed SBs are incorporated before the engine reaches 6000 hours.

- SB24334 (HPT Compressor Abradable)
- SB24280 (Impeller Housing Outer Diameter Reduction
- SB24444 (Combustion Chamber Liner)

(4) The recommended TBO interval is 7200 hours, plus 50 hours. The additional 50 hours is for scheduling purposes.

(5) Operators who wish to use the extended TBO program may do so provided:

- The rotor component life limitations, as outlined in the AIRWORTHINESS LIMITATIONS section of this manual, are not exceeded.

- Only Post-SB24419 vanes are used after 5000 hours.
- Prior to 5000 hours Pre-SB24419 vanes are subject to replacement per the Periodic Inspection Table.
- All SBs listed in the 6000 hour Extended TBO are incorporated prior to the engine reaching 5000 hours.

D. Extended HSI - 3600 Hours

The recommended HSI interval is 3600 hours, plus 50 hours. The additional 50 hours is for scheduling purposes. Refer to TABLE 1, Periodic Inspection for maintenance interval.

Operators who wish to use the extended HSI program may do so provided:

- The rotor component life limitations, as outlined in the AIRWORTHINESS LIMITATIONS section of this manual, are not exceeded.
- All SBs listed in the 3000 hour Extended HSI are incorporated prior to the HPT components reaching 2500 hours.
- The SBs listed in Para. C, Extended TBO - 7200 Hours, above, are incorporated before the HPT components reach 3000 hours.

E. Rotor Component Life

Rotor component life limitations as outlined in the AIRWORTHINESS LIMITATIONS section of this manual override TBO consideration.

4. Engine Accessories

A. Engine accessories are included in a continuous maintenance program, which recommends that those units listed in Para. B. are monitored for condition and operation while in service and undergo a functional inspection at engine TBO.

B. The following accessories are included:

- EEC (Ref. 73-20-02)
- HMU (Ref. 73-20-01)
- AC Generator (Ref. 72-60-01)
- Fuel Pump (Ref. 73-10-02)
- Fuel Dump/Start Valve (Ref. 73-10-05)
- Fuel Filter Bypass Switch (Ref. 73-10-03)
- Fuel Waste Ejector Tank (Ref. 73-10-03)
- Motive Flow Valve (Ref. 73-10-02)
- Wiring Harnesses (Ref. 73-20-03)
- Ignition Exciter Boxes (Ref. 74-10-01)

- Igniter Plugs (Ref. 74-10-01)
- Ignition Cables (Ref. 74-10-01)
- Anti-icing Valve (Ref. 75-10-01)
- Rotary or Linear Stator Vane Actuator (Ref. 75-30-04)
- N2 Speed Sensors (Ref. 77-10-01)
- P1/T1 Sensors (Ref. 77-20-02)
- T4.5 Harnesses and T4.5 Terminal Box (Ref. 77-20-01)
- Fuel/Oil Heat Exchanger (Ref. 79-20-02)
- Oil Filter Bypass Switch (Ref. 79-20-01)
- Oil Pressure Differential Switch (Ref. 79-30-02)
- Oil Pressure Differential Indicator (Pop-up Indicator) (Ref. 79-30-03)

5. TBO Extension Program

A. Further increases to the generic TBO are subject to the approval of the operator's local regulatory authority and it is the responsibility of individual operators to make applications for such increases.

B. P&WC will support individual operator's efforts to extend their fleet specific TBO. Typically, a single engine sample representative of either a single or multi-aircraft fleet will be required for an escalation of 500 hours over the published limits. The engine sample will require a detailed life assessment inspection by an authorized PW305 overhaul facility to establish if further life is capable in that particular operation.

C. Operators desiring P&WC support for its application for TBO extension should submit a formal request in writing, together with details of the sample engine condition with name and address of the overhaul facility to:

Pratt & Whitney Canada
1000 Marie-Victorin
Longueuil, Quebec
Canada J4G 1A1

Attention: Manager
Customer Solutions
Small Turbofan Engines

6. Engine Externals and Compressor Wash

Engine cleaning is basically confined to compressor desalination or performance recovery washes. However, an external wash is recommended when the engine is operated in an environment where atmospheric contamination exists.

Environmental conditions vary depending on engine operation and geographical location. Air pollution and salt-water exposure are examples of adverse environments. Chemical reactions with the fuel and heat can produce severe corrosion, which can be significantly reduced through regular gas path washing.

Table 1 provides wash recommendations to reduce the rate of engine deterioration when the engine is operated in adverse environments. Periodic inspection of the engine externals, compressor inlet, and compressor gas path components for contamination can also be used as a basis for establishing external and internal wash requirements.

Engine wash schedule requirements, compressor and external, are to be determined by the operator, with consideration of the specific aircraft operating and environmental condition. Wash frequency should be adjusted to suit the engine's exposure to adverse environmental conditions. Exposure determination of continual, frequent or occasional operation should consider factors such as: time at altitude, home-base environment, destination, and storage in a sheltered, air-controlled hangar.

TABLE 1, Compressor Wash Schedule Recommendation

Component	Inspection/Task	Initial Interval	Subsequent Interval
Engine -Aircraft continually operated in dusty, sandy, heavily polluted or salt laden environment.	Desalination Wash (Ref. Chap. 71-00-00, POWERPLANT - CLEANING)	Daily (See Note 1)	Daily (See Note 1)
-Aircraft frequently operated in dusty, sandy, heavily polluted or salt laden environment.	Desalination Wash (Ref. Chap. 71-00-00, POWERPLANT - CLEANING)	Weekly (See Note 1)	Weekly (See Note 1)
-Aircraft occasionally operated in dusty, sandy, heavily polluted or salt laden environment.	Desalination Wash (Ref. Chap. 71-00-00, POWERPLANT - CLEANING)	Bi-weekly (See Note 1)	Bi-weekly (See Note 1)
-Performance Recovery	Performance Recovery Wash (Ref. Chap. 71-00-00, POWERPLANT - CLEANING)	As required by ECTM (every approx. 10°C ITT increase) and by visual inspection of compressor gas path.	As required by ECTM (every approx. 10°C ITT increase) and by visual inspection of compressor gas path.

NOTE: 1. Adjust washing frequency to suit engine condition.

NOTE: 2. Pollution - the process of polluting the atmosphere by the discharge of harmful substances, causing contamination with, for example, volcanic dust or corrosive chemicals such as those found in industrial smog.

TABLE 1, Compressor Wash Schedule Recommendation (Cont'd)

Component	Inspection/Task	Initial Interval	Subsequent Interval

NOTE: 3. Salt laden environment - the presence of salt haze, created by finely divided particles of sea salt in the air, usually derived from the evaporation of sea spray.

NOTE: 4. A motoring wash for light soil or multiple motoring washes for heavy soil contamination is recommended.

NOTE: 5. Multiple motoring washes should be performed to the extent permitted by starter operating limitations. Observe starter cooling period (Ref. Starter manufacturer's manual).

NOTE: 6. Operators can consult local P&WC Field Service Representative or Customer Help Desk for assistance to develop their individual wash schedule.

NOTE: 7. Minor nicks or scratches to magnesium cases can be repaired per Chapter 70-00-00, Standard Practices - Repair.

7. Low Utilization Engine Inspection Program

A. Engines that will not achieve overhaul within the intervals specified in the subsequent paragraph are defined as low utilization.

NOTE: Preservation/Depreservation procedures must be followed and documented in the engine log book for engines inactive for a period exceeding 28 days (Ref. Chapter 72-00-00, SERVICING).

B. The recommended initial low utilization inspection interval is 2 tier.

The first tier is an in-service inspection to take place 13 years from the date of manufacture or 12 years from the entry into service (Ref. Chapter 72-00-00, In-Service, Low Utilization Engine Inspection, ENGINE, GENERAL - INSPECTION).

The second tier is an in-service inspection to take place 15 years from the date of manufacture or 14 years from the entry into service (Ref. Chapter 72-00-00, In-Service, Low Utilization Engine Inspection, ENGINE, GENERAL - INSPECTION). Subsequently, the recommended initial low utilization inspection interval is 14 years from the last tier two inspection or the last overhaul.

For scheduling purposes, the interval may be increased by up to 12 months.

C. PW305 engines converted to PW305A by SB24229 or to PW305B by SB24224 are considered to have been manufactured at that time. This process was done at a P&WC facility and required a full strip of the engine, Service Bulletin update and significant replacement of engine parts. Initial low utilization inspection interval of these engines shall be calculated from the date of this conversion.

D. P&WC will support individual operator's efforts to extend their fleet specific calendar interval. Typically, a single engine sample representative of either a single or multi-aircraft fleet will be required for an escalation of up to two years over the published limits. The engine sample will require a detailed life assessment inspection by an authorized PW305 overhaul facility to establish if further life is capable in that particular operation.

E. Operators desiring P&WC support for an application for calendar time extension should submit a formal request in writing, together with details and operating history of the sample engine condition with name and address of the overhaul facility to:

Pratt & Whitney Canada
1000 Marie-Victorin
Longueuil, Quebec
Canada J4G 1A1

Attention: Manager
Customer Solutions
Small Turbofan Engines

8. Periodic Inspections

Table 2 details periodic inspection criteria and frequency.

TABLE 2, Periodic Inspection

Component	Nature of Inspection	Inspection Type: Pre-Flight/ Daily	Inspection Type: Minor
1. ENGINE			
EEC	Check security of Post-SB24379 silicone sealant in vent holes. NOTE: Post-SB24381 EECs do not require MINOR inspection.		X
EDU	Check advisory data in cockpit (Ref. AMM) for the EDU battery expiry date.		X
Tubing	Check for security of all accessible connections, clamps and brackets, evidence of wear, chafing, cracks and corrosion and evidence of fuel or oil leaks. NOTE: Damage limits and repair instructions for tubing are given in Chapter 70-00-00, INSPECTION.		X
Wiring	Check for security of all accessible connections, clamps and brackets and for evidence of wear, chafing, cracks and corrosion.		X
Wiring Harness Connectors	Check for security.		X
PMA Harness Connectors	Remove, check condition, clean and reinstall. CAUTION: DO NOT USE ELECTRICAL ENHANCER ON PMA HARNESS CONNECTORS.	Every 1200 hours.	
Engine Mounts	Security and condition.		X

TABLE 2, Periodic Inspection (Cont'd)

Component	Nature of Inspection	Inspection Type: Pre-Flight/ Daily	Inspection Type: Minor
Fan Case and Compressor Inlet	Check for cleanliness and damage. Check LP compressor blades for FOD, deposits, corrosion and erosion.	X	X
Bypass Ducts	Check inner and outer bypass ducts for damage.		X
Fan Blades	Check for erosion of LE thickness using gage (PWC60640). Replace fan if measured thickness is greater than 0.055 inch (1.40 mm). NOTE: This check is only necessary for engines being operated in a sand-laden environment.		X
Fan Exit Stator Vanes	Check for FOD, deposits, corrosion and erosion.		X
Exhaust Duct	Cracks or distortion.		X
Accessories	Security of installation. Check for fuel and oil leaks externally and at drains.		X
LP Turbine Area	Any obvious damage and/or deterioration.	X	
Pre-SB24349 Combustion Chamber Liner	Check for cracks around igniter bosses. Refer to 72-00-00, INSPECTION for damage limits.		X
Pre-SB24365 Combustion Chamber Liner	Check for cracks around igniter bosses. Refer to 72-00-00, INSPECTION for damage limits.	Every 1200 hours or nearest airframe inspection; whichever comes first.	
HP Turbine Second-stage Vane (Pre-SB24419)	Replace.	2250 Hours	
Intermediate Case and AGB	Check for security and corrosion		X
First-stage HP Compressor Rotor (PW305A Only)	Pre-SB24425: Do an eddy current inspection (Ref. 72-00-00 INSPECTION).	Every 300 hours, + 25 hours for scheduling. Initial inspection at 2500 hours.	

TABLE 2, Periodic Inspection (Cont'd)

Component	Nature of Inspection	Inspection Type: Pre-Flight/ Daily	Inspection Type: Minor
		For rotors with more than 2500 hours and not previously inspected, do an inspection within 300 hours from January 30, 2004.	
		For previously inspected rotors with more than 2500 hours and more than 200 hours since the last inspection, do an inspection within 100 hours from January 30, 2004.	
	Post-SB24425 (or has First-stage HPC Rotor P/N 30B2799-01 installed): Do an eddy current inspection (Ref. 72-00-00 INSPECTION).	Every 300 hours, + 25 hours for scheduling. Initial inspection at 1200 hours.	
		For rotors with between 900 and 2000 hours and not previously inspected, do an inspection within 300 hours from 30 January, 2004.	
		For rotors with between 900 and 2000 hours and previously inspected with more than 200 hours since the last inspection, do an inspection within 100 hours from 30 January, 2004.	
		For rotors with more than 2000 hours and not previously inspected, do an inspection within 100 hours from 30 January, 2004.	

TABLE 2, Periodic Inspection (Cont'd)

Component	Nature of Inspection	Inspection Type: Pre-Flight/ Daily	Inspection Type: Minor
		For rotors with more than 2000 hours and previously inspected with more than 200 hours since the last inspection, do an inspection within 100 hours from 30 January, 2004.	
	Post-SB24569 (or has First-stage HPC Rotor P/N 30B6531-01 installed): Do an eddy current inspection (Ref. 72-00-00 INSPECTION).	Every 300 hours, + 25 hours for scheduling. Initial inspection at 1200 hours.	
Impeller Shroud Pressure Check	Pre-SB24280 engines require repeated incorporation of SB24453 (Impeller Shroud Pressure Check) at the required interval.	Every 3000 hours, ± 300 hours.	
		If the engine has already exceeded 3000 hours either since new or since last impeller shroud pressure check, the inspection must be performed within 300 hours.	
2. OIL SYSTEM			
	NOTE: P&WC does not recommend the casual mixing of different brands or types of oil. If oil mixing is necessary, refer to Chapter 72-00-00, ENGINE, GENERAL - DESCRIPTION AND OPERATION and ENGINE - SERVICING.		
Oil Change Interval	Every 600 hours ± 50 hours or one (1) year, whichever occurs first.		
Oil Quantity	Check oil level and replenish if required (Ref. 72-00-00, SERVICING). Check condition and security of oil filler cap.	X	X
Impending Bypass Indicator	Check for protruding indicator (red button). Replace oil filter if indicator has popped out.		
	Aircraft with cockpit indication.		X

TABLE 2, Periodic Inspection (Cont'd)

Component	Nature of Inspection	Inspection Type: Pre-Flight/ Daily	Inspection Type: Minor
	Aircraft without cockpit indication.	X	
Chip Detector	Remove and check for metallic pick-up. Using a suitable ohmmeter, check for continuity of electrical circuit when the two poles are shorted together. Reject detector if no continuity. Loose pins are also cause for rejection.		X
	For further inspection details refer to 72-00-00, SERVICING.		
Oil Filter Element	Remove, inspect and check for foreign matter and damage.		X
	Replace (regardless of filter condition), every 12 months, OR for high utilization aircraft (900 or more hrs/yr), every 12 months or every 1200 hours, whichever comes first.		
AGB Pad Seals	Check pad seal for oil leaks. Leak rate of 1 drop per 5 minutes from any pad seal is acceptable.		X
AGB Rear Cover	Check for foreign deposits. Wipe clean if found.		X
3. FUEL SYSTEM			
Fuel Pump	Security and leakage.		X
HMU	Security, leakage, and fuel leaks at tube connections.		X
	Check for carbon deposits. Wipe clean if found.		X
Fuel Filter	Remove and check for foreign matter and damage.		X
	Replace (regardless of filter condition), every 12 months, OR for high utilization aircraft (900 or more hrs/yr), every 12 months or every 1200 hours whichever comes first.		
Dump Valve	Security and leakage.		X
Emergency FSOV (Pre-SB24430 only)	Check emergency fuel shut-off tripper dimension T (Ref. 73-10-05), and adjust if necessary (Ref. 73-10-05).		X
Fuel/Oil Heat Exchanger	Security and leakage.		X

TABLE 2, Periodic Inspection (Cont'd)

Component	Nature of Inspection	Inspection Type: Pre-Flight/ Daily	Inspection Type: Minor
Fuel Waste Ejector	Security and leakage.		X
4. AIR SYSTEM			
P1 and P3 Air Tubes	Drain condensation traps. Check for wear, chafing, cracks and corrosion.		X
P2.5 and P2.8 Bleed Valves	Clean and inspect BOVs (Ref. 75-30-01).	Every HSI and overhaul.	
BOV Solenoid	Replace solenoid with a new or overhauled Post-SB24484 solenoid. Inspect and clean front core harness connectors (Ref. 70-00-00), and reinstall (Ref. 73-20-03).	Replace every 1500 hours ± 300 hours. For solenoids in service with over 1800 hours, accomplish within 100 hours of the issue date of this Temporary Revision (TR05-26) of this Maintenance Manual.	
5. IGNITION SYSTEM			
Ignition Exciters	Security and corrosion.		X
Ignition Cables	Chafing, wear and security.		X
Spark Igniters	Cleanliness and erosion.		X
	Operational test.		X
6. INDICATION			
P1/T1 Sensors	Remove connector, inspect and clean (Ref. 70-00-00), reinstall (Ref. 77-20-02).	Every 600 hours, or nearest airframe inspection, whichever comes first.	
Pre-SB24545 (PW305B only): N1 Speed Sensors	Replace	Every HSI and overhaul. For Pre-SB24545 (PW305B only) N1 Speed Sensors replaced prior to, or after last HSI, replace at every HSI and overhaul.	

TABLE 2, Periodic Inspection (Cont'd)

Component	Nature of Inspection	Inspection Type: Pre-Flight/ Daily	Inspection Type: Minor
Post-SB24545 (PW305B only): N1 Speed Sensors	Visual check for condition of accessible wiring harnesses and security of connectors.	Every HSI and overhaul.	
Pre-SB24546 (PW305A only): N1 Speed Sensors	Replace	Every HSI and overhaul.	
		For Pre-SB24546 (PW305A only) N1 Speed Sensors replaced prior to, or after last HSI, replace at every HSI and overhaul.	
Post-SB24546 (PW305A only): N1 Speed Sensors	Visual check for condition of accessible wiring harnesses and security of connectors.	Every HSI and overhaul.	
7. EXTENDED TBO AND HSI FREQUENCY			
Fuel Nozzles	Refer to 73-10-04, INSPECTION for damage limits.	Every HSI and overhaul.	
Combustion Chamber Liner	Refer to 72-40-01, INSPECTION for damage limits.	Every HSI and overhaul.	
Bleed Valves	Clean and inspect BOVs (Ref. 75-30-01).	Every HSI and overhaul.	
BOV Solenoid	Replace solenoid with a new or overhauled Post-SB24484 solenoid. Inspect and clean front core harness connectors (Ref. 70-00-00), and reinstall (Ref. 73-20-03).	Replace every 1500 hours ± 300 hours. For solenoids in service with over 1800 hours, accomplish within 100 hours of the issue date of this Temporary Revision (TR05-26) of this Maintenance Manual.	
Pre-SB24545 (PW305B only): N1 Speed Sensors	Replace	Every HSI and overhaul.	

TABLE 2, Periodic Inspection (Cont'd)

Component	Nature of Inspection	Inspection Type: Pre-Flight/ Daily	Inspection Type: Minor
		For Pre-SB24545 (PW305B only) N1 Speed Sensors replaced prior to, or after last HSI, replace at every HSI and overhaul.	
Post-SB24545 (PW305B only): N1 Speed Sensors	Visual check for condition of accessible wiring harnesses and security of connectors.	Every HSI and overhaul.	
Pre-SB24546 (PW305A only): N1 Speed Sensors	Replace	Every HSI and overhaul.	
		For Pre-SB24546 (PW305A only) N1 Speed Sensors replaced prior to, or after last HSI, replace at every HSI and overhaul.	
Post-SB24546 (PW305A only): N1 Speed Sensors	Visual check for condition of accessible wiring harnesses and security of connectors.	Every HSI and overhaul.	
8. EXTENDED TBO AND HSI FREQUENCY - 7200 HOUR TBO AND 3600 HSI ONLY			
Fuel Nozzles	Refer to 73-10-04, INSPECTION for damage limits.	Every HSI and overhaul.	
Primary Fuel Nozzles	Clean primary fuel nozzles (Ref. Chapter 73-10-04, CLEANING/PAINTING)	Every 1800 hours +/- 600 hours.	
Combustion Chamber Liner	Refer to 72-40-01, INSPECTION for damage limits.	Every HSI and overhaul.	
P2.5 and P2.8 Bleed Valves	Clean and inspect BOVs (Ref. Chapter 75-30-01).	Every HSI and overhaul.	

TABLE 2, Periodic Inspection (Cont'd)

Component	Nature of Inspection	Inspection Type: Pre-Flight/ Daily	Inspection Type: Minor
BOV Solenoid	Replace solenoid with a new or overhauled Post-SB24484 solenoid. Inspect and clean front core harness connectors (Ref. 70-00-00), and reinstall (Ref. 73-20-03).	Replace every 1500 hours ± 300 hours. For solenoids in service with over 1800 hours, accomplish within 100 hours of the issue date of this Temporary Revision (TR05-26) of this Maintenance Manual.	
Pre-SB24545 (PW305B only): N1 Speed Sensors	Replace	Every HSI and overhaul.	
		For Pre-SB24545 (PW305B only) N1 Speed Sensors replaced prior to, or after last HSI, replace at every HSI and overhaul.	
Post-SB24545 (PW305B only): N1 Speed Sensors	Visual check for condition of accessible wiring harnesses and security of connectors.	Every HSI and overhaul.	
Pre-SB24546 (PW305A only): N1 Speed Sensors	Replace	Every HSI and overhaul.	
		For Pre-SB24546 (PW305A only) N1 Speed Sensors replaced prior to, or after last HSI, replace at every HSI and overhaul.	
Post-SB24546 (PW305A only): N1 Speed Sensors	Visual check for condition of accessible wiring harnesses and security of connectors.	Every HSI and overhaul.	

NOTE: It is P&WCs intention that this inspection be performed at the operator's convenience at a suitable airframe inspection or other convenient time within the range specified.

9. BORESCOPE

TABLE 2, Periodic Inspection (Cont'd)

Component	Nature of Inspection	Inspection Type: Pre-Flight/ Daily	Inspection Type: Minor
Pre-SB24349 Combustion Chamber Liner	Check for cracks around igniter bosses. Refer to 72-00-00, INSPECTION for damage limits.		X
Pre-SB24365 Combustion Chamber Liner	Check for cracks around igniter bosses. Refer to 72-00-00, INSPECTION for damage limits.	Every 1200 hours or nearest airframe inspection; whichever comes first.	
HP Compressor Rotor Drum, P/Ns 30B2542 and 30B2478.	Check for cracks (Ref. 72-00-00, INSPECTION).	Every 1350 cycles or nearest airframe inspection, not exceeding the 1350 cycle limit.	
10. ECTM BORESCOPE WORKSCOPE			
Fuel Nozzles	Refer to 72-00-00, INSPECTION for damage limits.	Ref. NOTES 1 and 2 below.	
Combustion Chamber Liner	Refer to 72-40-01, INSPECTION for damage limits.	Ref. NOTES 1 and 2 below.	
First-stage HP Turbine Vane	Refer to 72-00-00, INSPECTION for damage limits.	Ref. NOTES 1 and 2 below.	
First-stage HP Turbine Blades	Refer to 72-00-00, INSPECTION for damage limits.	Ref. NOTES 1 and 2 below.	
Second-stage HP Turbine Blades	Refer to 72-00-00, INSPECTION for damage limits.	Ref. NOTES 1 and 2 below.	
Third-stage LP Turbine Vane	Refer to 72-00-00, INSPECTION for damage limits.	Ref. NOTES 1 and 2 below.	
Third-stage LP Turbine Blades	Refer to 72-00-00, INSPECTION for damage limits.	Ref. NOTES 1 and 2 below.	
Fifth-stage LP Turbine Blades	Refer to 72-00-00, INSPECTION for damage limits.	Ref. NOTES 1 and 2 below.	
Fifth-stage LP Turbine Vane	Refer to 72-00-00, INSPECTION for damage limits.	Ref. NOTES 1 and 2 below.	
P2.5 and P2.8 Bleed Valves	Clean and Inspect (Ref. 75-30-01)	At 3000 hours, +/- 300 hours.	
BOV Solenoid	Replace.	At 3000 hours, +/- 300 hours.	
N1 Speed Sensors	Replace.	At 3000 hours, +/- 300 hours.	

TABLE 2, Periodic Inspection (Cont'd)

Component	Nature of Inspection	Inspection Type: Pre-Flight/ Daily	Inspection Type: Minor
NOTE 1: At 2500 hours since new or overhaul and every minor inspection or 360 hour interval thereafter, whichever comes first.			
NOTE 2: At 3000 hours since new or overhaul and every minor inspection or 360 hour interval thereafter, whichever comes first. Applicable to all PW305, PW305A and PW305B engines which have had the following SBs or superseding SBs incorporated: SB24365 (Combustion Chamber Liner) SB24419 (Second-Stage Vane) SB24428 (No. 1 Bearing) SB24437 (Fuel Nozzles) SB24458 (Intershaft Seal Housing) SB24459 (Preformed Packing for Intershaft Seal Housing) SB24460 (Intershaft Carbon Seals)		

TABLE OF CONTENTS

SUBJECT	PAGE
UNSCHEDULED MAINTENANCE CHECKS	**05-50-00**
1. General	1
2. Foreign Object Damage (FOD)	1
A. Procedure	1
3. Engine Windmilling In Flight	2
A. Windmilling for Less than 15 Minutes	2
B. Windmilling for More than 15 Minutes	2
4. Low and/or Fluctuating Oil Pressure	3
A. Oil Pressure Between 36 and 20 psig	3
B. Oil Pressure Less Than 20 psig	3
5. Lightning Strike	5
A. Procedure	5
6. Engine Immersion in Water	6
A. Procedure	6
7. Dropped Engine	6
A. Procedure	6
8. Aircraft Flown Through a Cloud of Volcanic Ash	6
A. Procedure	6
9. Engine Exposed to Fire Extinguishing Agent	7
A. Procedure	7
10. Heavy Landing	7
A. Procedure	7
11. Sustained Running at an Oil Temperature Outside of Limits	8
A. Procedure	8

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Feb 15/2008
	2 blank	Feb 15/2008
Contents	1	Feb 15/2008
	2 blank	Feb 15/2008
05-50-	1	Feb 15/2008
Unscheduled	2	Feb 15/2008
Maintenance	3	Feb 15/2008
Checks	4	Feb 15/2008
	5	Feb 15/2008
	6	Feb 15/2008
	7	Feb 15/2008
	8	Feb 15/2008

UNSCHEDULED MAINTENANCE CHECKS

1. General

CAUTION: A PERFORMANCE CHECK MUST NOT BE DONE ON ENGINES WHICH HAVE EXCEEDED OPERATING LIMITATIONS (EG: OVERSPEED IN EXCESS OF TRANSIENT, OVERTEMPERATURE ETC.) OR WHICH HAVE UNSATISFACTORY CONDITIONS WHICH CAN EXTEND WITH ENGINE RUNNING (IE: OIL SYSTEM CONTAMINATION, ETC.).

An unscheduled maintenance inspection is carried out when the engine is subjected to unusual stress or operating conditions, exceeds operating limitations or gives unsatisfactory performance.

If, as the result of the inspection, engine removal is required, a written report, stating the cause of removal in detail (e.g. overspeed, overtemperature etc.) must be sent with the engine to an overhaul/repair facility.

If an operational engine must be removed, a performance check (Ref. 71-00-00, ADJUSTMENT/CHECK) is recommended before engine removal to determine the extent of repair required.

2. Foreign Object Damage (FOD)

A. Procedure

(1) Investigate each instance of FOD to determine cause and circumstance.

(2) Inspect cone, fan blades, case and/or inner and outer stators. If damage indicates that a foreign object might have entered the HP compressor, do a borescope inspection of 1st stage IGV and compressor blades.

(3) Continue downstream borescoping if indication is found that the foreign object might have affected downstream components. Return engine to an overhaul facility if damage found is not acceptable for continuing in operation.

(4) If damage is acceptable for continuing in operation, rotate the LP and HP rotors by hand and listen for unusual noise. Return engine to an overhaul facility if unusual noise or roughness is heard.

(5) Inspect chip detector and oil filter. Refer to oil system contamination (Ref. Chapter 72-00-00, FAULT-ISOLATION-1) if debris is found in oil filter or chip detector.

(6) In case of bird strike, if there is evidence that the bird remains might have entered the HP compressor, do a borescope inspection, do and a power recovery wash. Check that P2.5 and P3 bleed ports are clear of contamination.

(7) Start engine and ground run. Check that the engine operates normally.

3. Engine Windmilling In Flight

A. Windmilling for Less than 15 Minutes

(1) No inspection required.

B. Windmilling for More than 15 Minutes

(1) If there was positive pressure indication during windmilling do an oil level check before returning the engine to service. If the oil level is low, some oil could be in the accessory gearbox, therefore, draining the AGB or an engine start might be required before servicing.

NOTE: If the fuel supply to the engine was cut off during windmilling the fuel pump might have run dry and need to be replaced as a precaution.

(2) If there was no positive oil pressure indication:

(a) Turn the low pressure (LP) rotor by hand and listen for unusual noises coming from the fan and turbine bearings.

(b) Turn the high pressure (HP) rotor using suitable hand crank with a 1/2 inch square-drive, installed in the AGB centrifugal breather outlet. Listen for unusual noises coming from bearings and gears.

(c) If unusual noises are heard, return the engine to an overhaul shop.

(d) Inspect chip detector and oil filter. Refer to oil system contamination (Ref. Chapter 72-00-00, FAULT-ISOLATION-1) if debris is found in oil filter or chip detector. Clean and reinstall oil filter and chip detector.

(e) Check oil level .

(f) Start engine and ground run up to take off power. Check that engine parameters are normal.

(g) Repeat the chip detector and oil filter inspection. If metallic debris are found return the engine to an overhaul facility.

(h) Repeat the oil level check and service the oil system if required

(i) In addition continue to inspect the chip detector every 10 flight hours until 65 flight hours is exceeded. If debris is found, refer to the oil system contamination troubleshooting charts. (Ref. Chapter 72-00-00, FAULT-ISOLATION-1)

NOTE: This check is not required for aircraft equipped with a functional cockpit chip detector indicating system. However it is recommended to do an operational check of the chip detector (Ref. Chapter 79-30-01, MAINT. PRAC.) and the cockpit indicating system (Ref. AMM) to make sure that the system works correctly. If debris is found, refer to the oil system contamination troubleshooting charts. (Ref. Chapter 72-00-00, FAULT-ISOLATION-1)

(j) Check oil filter (Ref. Chapter 79-20-01, INSPECTION) at 65 ± 5 flight hours. If debris is found, carry out procedure for debris in oil system (Ref. Chapter 72-00-00, FAULT-ISOLATION-1).

(k) If no debris is found, the engine may continue in service with subsequent inspections carried out as defined per the relevant maintenance program.

4. Low and/or Fluctuating Oil Pressure

CAUTION: ENGINE MUST BE SHUT DOWN AS REQUIRED BY FLIGHT MANUAL IF OIL PRESSURE IS BELOW THE DEFINED LIMITS (Ref. Chapter 05-10-00, OPERATING LIMITS AND LEADING PARTICULARS). ENGINES WITH LOW OIL PRESSURE AND/OR LOSS OF OIL PRESSURE KEPT RUNNING LONGER THAN REQUIRED TO COMPLY WITH FLIGHT MANUAL MUST BE REMOVED AND RETURNED TO AN OVERHAUL FACILITY FOR AN INSPECTION TO BE DONE IN ACCORDANCE WITH OVERHAUL MANUAL IF OIL PRESSURE INDICATING SYSTEM FUNCTIONS CORRECTLY.

A. Oil Pressure Between 36 and 20 psig

(1) Engine operation with oil pressure between 20 and 36 psig at a power setting below Max. Cruise is not considered a low oil pressure event and does not require special inspection.

(2) If the engine was operated at or above Max. Cruise, with oil pressure between 20 and 36 psi, proceed as per Para. B., following.

B. Oil Pressure Less Than 20 psig

(1) Check engine/aircraft oil pressure indicating system. If satisfactory and the engine was shut down as required by the flight manual, do the following:

(a) Turn the LP rotor by hand and listen for unusual noises coming from the fan and turbine bearings.

(b) Turn the HP rotor using a suitable hand crank and square-drive, installed in the AGB centrifugal breather outlet. Listen for unusual noises coming from bearings, seals, gears, HP impeller and turbine.

(c) If unusual noises are heard, return the engine to an overhaul shop.

(d) Inspect chip detector (Ref. Chapter 79-30-01, INSPECTION) and main oil filter (Ref. Chapter 79-20-01, INSPECTION). If debris is found, do fault isolation procedure for debris in oil system (Ref. Chapter 72-00-00, FAULT-ISOLATION-1).

(e) If no debris is found, install clean filter and chip detector.

(f) If reason for low or loss of oil pressure has not been determined, check/rectify the following:

- engine external oil leaks
- oil pressure transmitter and associated electrical harness and tubing

- overboard oil drains for oil leaks
- oil level
- oil tank overpressure indicator
- oil, for the smell of fuel
- pressure adjustment valve
- pressure oil pump
- AGB scavenge pump

(g) If no debris is found (Ref. Step (d)), check oil level and/or service. Start engine and ground run to T.O. power.

(h) Inspect chip detector (Ref. Chapter 79-30-01, INSPECTION) and main oil filter (Ref. Chapter 79-20-01, INSPECTION). If metallic/magnetic debris is found, return the engine to an overhaul shop. Indicate loss of oil pressure.

(i) Check oil level (Ref. Chapter 72-00-00, SERVICING), if low, do procedure for high oil consumption (Ref. Chapter 72-00-00, FAULT-ISOLATION-1).

(j) Monitor oil consumption for 65 flight hours.

(k) In addition continue to inspect the chip detector every 10 flight hours until 65 flight hours is exceeded. If debris is found, refer to the oil system contamination troubleshooting charts. (Ref. Chapter 72-00-00, FAULT-ISOLATION-1)

NOTE: This check is not required for aircraft equipped with a functional cockpit chip detector indicating system. However it is recommended to do an operational check of the chip detector (Ref. Chapter 79-30-01, MAINT. PRAC.) and the cockpit indicating system (Ref. AMM) to make sure that the system works correctly . If debris is found, refer to the oil system contamination troubleshooting charts. (Ref. Chapter 72-00-00, FAULT-ISOLATION-1)

(l) Inspect oil filter (Ref. Chapter 79-20-01, INSPECTION) at 65 ± 5 flight hours. If debris is found, do procedure for debris in oil system (Ref. Fault Isolation). If no debris is found, the engine may continue in service with subsequent inspections done as defined per the relevant maintenance program.

(2) If engine was not shutdown, proceed as follows:

(a) Remove and inspect chip detector (Ref. 72-00-00, SERVICING), oil filter (Ref. 79-20-01), and AGB scavenge oil screen (Ref. 72-60-01).

(b) Obtain oil samples and send to an approved labarotory for analysis.

(c) If AMS6491 (M50), AMS6414, or AMS6444 (52100) is found, remove engine and send to an approved overhaul facility for investigation.

(d) If no contamination is found proceed as follows:

1 Replace oil filter, service the engine with oil (Ref. 72-00-00, SERVICING) and do a high power run above 80% N2 for twenty minutes (Ref. 71-00-00).

2 Return engine to service and take an oil sample after 15 flight hours. Send sample to an approved laboratory for analysis.

3 Take another sample after 30 flight hours and send sample to an approved laboratory for analysis.

4 If both samples are clean, engine may continue in service.

5. Lightning Strike

A. Procedure

(1) Visually check engine inlet for evidence of arcing, pitting or black scarring, on nose cone or low compressor rotor blades. If evident return engine to an approved overhaul facility. Indicate ligtning strike.

(2) If a lightning strike is suspected but no evidence of arcing is visible, proceed as follows:

(a) Turn the low pressure rotor by hand and listen for unusual noises coming from the fan and turbine bearings. If unusual noises are heard, return the engine to an overhaul shop for lightning strike inspection.

(b) Inspect chip detector (Ref. Chapter 79-30-01, INSPECTION) and main oil filter (Ref. Chapter 79-20-01, INSPECTION). If debris is found, do procedure for debris in oil system (Ref. Chapter 72-00-00, FAULT ISOLATION-1).

(c) If debris is not found, install clean filter and chip detector.

(d) Visually inspect electrical harnesses (Ref. Chapter 73-20-03, INSPECTION) and check EEC fault codes.

(e) Start engine and ground run up to take off power. Check that engine parameters are normal.

(f) Inspect chip detector (Ref. Chapter 79-30-01, INSPECTION) and main oil filter (Ref. Chapter 79-20-01, INSPECTION). If metallic/magnetic debris is found, return the engine to an overhaul shop for lightning strike inspection in accordance with the Overhaul Manual instructions.

(g) Return the engine to service if no discrepancies are found.

(h) In addition continue to inspect the chip detector every 10 flight hours until 65 flight hours is exceeded. If debris is found, refer to the oil system contamination troubleshooting charts. (Ref. Chapter 72-00-00, FAULT-ISOLATION-1)

NOTE: This check is not required for aircraft equipped with a functional cockpit chip detector indicating system. However it is recommended to do an operational check of the chip detector (Ref. Chapter 79-30-01, MAINT. PRAC.) and the cockpit indicating system (Ref. AMM) to make sure that the system works correctly . If debris is found, refer to the oil system contamination troubleshooting charts. (Ref. Chapter 72-00-00, FAULT-ISOLATION-1)

(i) Inspect oil filter (Ref. Chapter 79-20-01, INSPECTION) at 65 ± 5 flight hours. If debris is found, do procedure for debris in oil system (Ref. Chapter 72-00-00, FAULT ISOLATION-1). If debris is not found, the engine may continue in service with subsequent inspections done as defined per the relevant maintenance program.

(j) Refer to the AMM for additional checks.

6. Engine Immersion in Water

A. Procedure

(1) Return engine to an overhaul facility for an inspection after immersion in water to be carried out in accordance with Overhaul Manual instructions (Ref. Light Overhaul).

7. Dropped Engine

A. Procedure

(1) Return engine to an overhaul facility for an inspection for dropped engines to be carried out in accordance with Overhaul Manual instructions (Ref. Light Overhaul).

8. Aircraft Flown Through a Cloud of Volcanic Ash

A. Procedure

(1) Do a compressor and turbine wash (Ref. 71-00-00, CLEANING).

(2) Drain and refill oil system with new oil (Ref. 72-00-00, SERVICING).

(3) Replace oil filter (Ref. 72-00-00, SERVICING).

(4) Do a borescope inspection of the compressor (Ref. 72-00-00, INSPECTION).

(5) Do a borescope inspection of the HP turbines (Ref. 72-00-00, INSPECTION) and check for glass-like deposits on turbine blades. If found, do a hot section inspection.

(6) Return engine to service if no unsatisfactory conditions are found.

(7) Drain and refill oil system with new oil (Ref. 72-00-00, SERVICING), 50 ± 10 flight hours after original oil change done at step 2.

9. Engine Exposed to Fire Extinguishing Agent

A. Procedure

(1) Foam, powder or other chemical extinguishers:

(a) If only engine externals are exposed, then wash immediately and monitor for corrosion. Otherwise, return engine to an overhaul facility to be inspected/repaired in accordance with Overhaul Manual instructions (Ref. Light Overhaul).

(2) Halon:

(a) No engine maintenance required.

10. Heavy Landing

A. Procedure

(1) The engine is designed to withstand landing loads of 6 g. If this load was imposed or exceeded during a heavy landing incident, do the checks listed below.

(2) If any of the following conditions are evident, replace engine:

- Cracks or distortion of engine mounts.
- Damage to engine air intake/fan case.
- Cracks or distortion of firewalls and bulkheads.
- Damage or insecurity of engine/airframe exhaust duct.

(3) Turn the HP rotor using a suitable hand crank with a 1/2 inch square-drive, installed in the AGB centrifugal breather outlet. Listen for unusual noises which can indicate problems in the accessory gears, bearings, seals and rotors. If unusual noises occur, remove engine for investigation.

(4) Check the following airframe/engine connections for security:

- fuel inlet
- fuel/oil heat exchanger
- indicating system
- ignition system
- air system
- fuel and oil drains

(5) Check all engine-mounted accessories for security. Rectify if required.

(6) Check for EEC Fault Codes (Ref. 72-00-00, FAULT ISOLATION).

(7) Do an Engine Performance Check (Ref. 71-00-00, ADJUSTMENT/TEST).

(8) Check for chip detector circuit completion (Ref. 72-00-00, SERVICING) and inspect oil filter. Repeat chip detector circuit check daily until 65 flight hours is exceeded. If no chip indications are found, the engine may remain in service with the subsequent inspection carried out as per the relevant maintenance program.

(9) Refer to the AMM for additional checks.

11. Sustained Running at an Oil Temperature Outside of Limits

NOTE: Refer to Chapter 05-10-00, OPERATING LIMITS AND LEADING PARTICULARS for oil temperature operating limits.

A. Procedure

(1) Drain and discard oil (Ref. 72-00-00, SERVICING).

(2) Remove and check oil filter (Ref. 72-00-00, SERVICING).

(3) Inspect chip detector (Ref. Chapter 70-00-00, SERVICING). If metallic/magnetic debris is found, return the engine to an overhaul shop.

(4) Rectify cause of high oil temperature (Ref. 72-00-00, FAULT ISOLATION-1).

(5) Fill oil system (Ref. 72-00-00, SERVICING).

(6) In addition continue to inspect the chip detector every 10 flight hours until 65 flight hours is exceeded. If debris is found, refer to the oil system contamination troubleshooting charts. (Ref. Chapter 72-00-00, FAULT-ISOLATION-1)

NOTE: This check is not required for aircraft equipped with a functional cockpit chip detector indicating system. However it is recommended to do an operational check of the chip detector (Ref. Chapter 79-30-01, MAINT. PRAC.) and the cockpit indicating system (Ref. AMM) to make sure that the system works correctly . If debris is found, refer to the oil system contamination troubleshooting charts. (Ref. Chapter 72-00-00, FAULT-ISOLATION-1)

CHAPTER

70

STANDARD PRACTICES (ENGINES)

TABLE OF CONTENTS

SUBJECT	PAGE
STANDARD PRACTICES - MAINTENANCE PRACTICES	**70-00-00**
1. General	201
2. Consumable Materials	202
3. Special Tools	202
4. Fixtures, Equipment and Supplier Tools	202
5. Special Limits and Torque Recommendations	203
A. General	203
B. Terms and Symbols	203
6. Standard Torques	203
A. General	203
7. Torque Indicating Devices	206
A. General	206
B. Torque Wrench and Extensions	206
8. Torque Recommendations	206
A. General	206
B. Antiseize Lubricated Parts	208
C. Nuts, Bolts and Screws	208
D. Self-locking Nuts	208
E. Lockwire and Cotterpin Requirements	210
F. Slotted, Steel Locknuts (Prevailing Torque Type)	210
G. Standard and Stepped Studs	210
H. Hose, Tubing and Threaded Couplings	210
9. Locking Devices	210
A. Keywashers (Tab and Cup Type)	210
B. Retaining Rings	212
C. Lockwire	212

TABLE OF CONTENTS

SUBJECT	PAGE
STANDARD PRACTICES - MAINTENANCE PRACTICES (Cont'd)	**70-00-00**
10. Identification of Hardware Material, Particularly Nuts and Bolts	213
11. Stainless Steel Bolts with Reduced Pitch Diameters	219
12. Identification of Metal Particles	219
A. General	219
B. Test Procedure	221
C. Test Procedure for Identification of Titanium Particles	222
13. Marking of Parts	223
A. General	223
B. Permanent Marking Methods	223
C. Temporary Marking Methods	224
14. Lubrication of Preformed Packings	225
A. Procedure	225
STANDARD PRACTICES - REMOVAL/INSTALLATION	**70-00-00**
1. General	401
2. Consumable Materials	402
3. Special Tools	402
4. Fixtures, Equipment and Supplier Tools	402
5. Removal/Installation	402
A. Removal of Straight Nipples, Straight Adapters, Bulkhead Couplings and Tube Connector Nipples	402
B. Removal of Tube-to-Boss Elbows, Elbow Adapters and Elbow Assemblies	402
C. Installation of Straight Nipples, Straight Adapters, Bulkhead Couplings and Tube Connector Nipples	403
D. Installation of Tube-to-Boss Elbows, Elbow Adapters and Elbow Assemblies	403
E. Electrical Connectors	404

TABLE OF CONTENTS

SUBJECT	PAGE
STANDARD PRACTICES - INSPECTION	**70-00-00**
1. General	601
2. Inspection	601
A. Inspection Procedure	601
B. Inspection Gages	601
C. Inspection of Fuel, Oil and Air Filters	602
D. Inspection of Welded Repairs	602
E. Inspection of Fuel, Oil and Air Tubes	602
F. Inspection of Rotating Components	608
STANDARD PRACTICES - CLEANING	**70-00-00**
1. General	701
2. Consumable Materials	701
3. Special Tools	701
4. Fixtures, Equipment and Supplier Tools	701
5. Cleaning	701
A. General Precautions	701
B. Cleaning Precautions	702
C. Cleaning Before Welding	702
D. Cleaning After Blending or Polishing	702
6. Wiring Harness Connectors	703
A. Cleaning	703
B. Application of Electrical Contact Enhancer	703
STANDARD PRACTICES - REPAIR	**70-00-00**
1. General	801
2. Consumable Materials	801
3. Special Tools	801

TABLE OF CONTENTS

SUBJECT	PAGE
STANDARD PRACTICES - REPAIR (Cont'd)	**70-00-00**
4. Fixtures, Equipment and Supplier Tools	801
5. Welding Repairs	802
A. General	802
B. Welding Equipment	802
C. Cleaning Before Welding	802
D. Welding Procedures	802
E. Cleaning After Welding	803
F. Local Stress Relief	804
G. Inspection of Welding	804
H. Blend Repair Procedure	804
6. Helical Coils	804
A. Replacement of Helical Coil Inserts	804
7. Studs	804
A. Replacement of Studs	804
B. Repair of Damaged Stud Hole	806
8. Shanknuts	807
A. Replacement	807
9. Electrical Connectors	807
10. Blend Repair of Rotating Components	809
A. General	809
B. Blend Repair Procedure	809
11. Anchor Nuts	811
A. Replacement	811
12. Jacking Insert	811
A. Replacement	811

TABLE OF CONTENTS

SUBJECT	PAGE
STANDARD PRACTICES - REPAIR (Cont'd)	**70-00-00**
13. Chromate Repair of Magnesium Casings (AGB and Intermediate Case)	811
A. Preparation of Chromate Conversion Solution (PWC11-019)	811
B. Preparation of Chrome Pickle Solution (PWC05-161)	812
C. Procedure	813
D. Restoration of Protective Coating on Painted Surfaces	813

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Feb 15/2008
	2 blank	Feb 15/2008
Contents	1	Feb 15/2008
	2	Feb 15/2008
	3	Feb 15/2008
	4	Feb 15/2008
	5	Feb 15/2008
	6 blank	Feb 15/2008
70-00-00 Maintenance Practices	201	Jun 08/2001
	202	Jul 16/2004
	203	Mar 02/2001
	204	Mar 02/2001
	205	Mar 02/2001
	206	Mar 02/2001
	207	Mar 02/2001
	208	Jun 08/2001
	209	Mar 02/2001
	210	Mar 02/2001
	211	Mar 02/2001
	212	Jul 16/2004
	213	Mar 02/2001
	214	Mar 02/2001
	215	Mar 02/2001
	216	Mar 02/2001
	217	Mar 02/2001
	218	Mar 02/2001
	219	Mar 02/2001
	220	Mar 02/2001
	221	Mar 02/2001
	222	Mar 02/2001
	223	Jun 08/2001
	224	Jun 08/2001
	225	Mar 02/2001
	226 blank	Mar 02/2001
70-00-00 Removal/ Installation	401	Jun 08/2001
	402	Apr 11/2003
	403	Apr 11/2003
	404	Apr 11/2003
	405	Nov 19/99
	406	Nov 19/99
	407	Nov 19/99
	408	Apr 11/2003
	409	Apr 11/2003
	410 blank	Apr 11/2003
70-00-00 Inspection Check	601	Feb 15/2008
	602	Feb 15/2008
	603	Feb 15/2008
	604	Feb 15/2008
	605	Feb 15/2008
	606	Feb 15/2008
	607	Feb 15/2008
	608	Feb 15/2008
	609	Feb 15/2008
	610 blank	Feb 15/2008
70-00-00 Cleaning/ Painting	701	Feb 15/2008
	702	Feb 15/2008
	703	Feb 15/2008
	704 blank	Feb 15/2008
70-00-00 Approved Repairs	801	Mar 16/2007
	802	Mar 16/2007
	803	Mar 16/2007
	804	Mar 16/2007
	805	Mar 16/2007
	806	Mar 16/2007
	807	Mar 16/2007
	808	Mar 16/2007
	809	Mar 16/2007
	810	Mar 16/2007
	811	Mar 16/2007
	812	Mar 16/2007
	813	Mar 16/2007
	814	Mar 16/2007

STANDARD PRACTICES - MAINTENANCE PRACTICES

1. General

A. Dust caps used to protect open tubes against contamination shall always be installed over the tube ends and not in the tube ends. Flow through the lines may be blocked off if lines are inadvertently installed with dust caps in the tube ends.

B. To ensure proper reinstallation, tag and mark all parts, clips, and brackets as to their location.

C. During removal of tubes or engine parts look for indications of scoring, burning or other undesirable conditions. To facilitate reinstallation, observe the location of each part during removal. Tag unserviceable parts and units for investigation and possible repair.

D. Extreme care shall be taken to prevent dust, dirt, lockwire, nuts, washers or other foreign matter from entering the engine. It cannot be overemphasized that this precaution applies whenever work is done on the engine either on the wing or off the wing. Suitable plugs, caps, and other covering shall be used to protect all openings as they are exposed.

E. If at any time items are dropped into the engine, the assembly process must stop until the dropped articles are located, even though this may require a considerable amount of time and labor. Before assembling or installing any part, be sure it is thoroughly clean.

F. Lockwire, lockwashers, tablocks, tabwashers, or cotterpins must never be reused. All lockwire and cotterpins must fit snugly in holes drilled in studs and bolts for locking purposes. Install a cotterpin so that the head fits into the castellation of the nut, and unless otherwise specified, bend one end of the pin back over the stud or bolt and the other end down flat against the nut. Only lockwire and cotterpins made of corrosion resistant steel shall be used. Bushing plugs shall be lockwired to the assembly boss or case. Do not lockwire the plug to the bushing.

G. Replace all gaskets, packings, and rubber parts at reassembly. Make sure that new nonmetallic parts to be installed (such as an oil seal) show no sign of having deteriorated in storage.

H. To protect critical areas of engine parts (such as compressor and turbine disks) against scratches and nicks, tool surfaces contacting these areas must be covered with protective material.

I. During replacement of components, note condition of any removed preformed packings. Pieces accidentally torn or cut from packings must be retrieved, regardless of size, even if this entails a systematic disassembly and cleaning of the system. Ensure that new packings are free of cuts, flashings and deformities which may be sheared off at installation.

J. When installing engine parts that require the use of a hammer to facilitate assembly or installation, use only a plastic or rawhide hammer.

K. Whenever adhesive tape has been applied to any part, the tape must be removed and the part thoroughly cleaned of all tape residue with petroleum solvent prior to being subjected to high temperature during engine run. Test results indicate that all tapes are capable of causing surface attack and/or reduction in tensile ductility as temperature increases. Do not leave tape or tape residue on engine parts.

L. If any part has been coated with corrosion preventive compounds, all traces of this compound and accumulated foreign matter must be removed.

2. Consumable Materials

The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC04-001	Grease, Synthetic
PWC05-004	Acid, Hydrofluoric
PWC05-006	Acid, Phosphoric Concentrated
PWC05-009	Ammonium Bifluoride
PWC05-038	Hydrogen Peroxide, Commercial Grade
PWC05-056	Sodium Hydroxide, Technical Grade
PWC05-074	Acid, Sulfuric
PWC05-089	Lockwire
PWC05-195	Acid, Nitric
PWC05-196	Acid, Hydrochloric
PWC06-001	Compound, Lubricating
PWC06-002	Petrolatum, White
PWC06-004	Compound, Antiseize
PWC06-004B	Compound, Antiseize

3. Special Tools

Not Applicable

4. Fixtures, Equipment and Supplier Tools

Not Applicable

5. Special Limits and Torque Recommendations

A. General

(1) Reference numbers on "Fits and Clearances", for applicable chapters, indicate the location of fits, clearances, and parts for which torque and spring pressures are specified. A description of, and limits for, these fits, clearances, torque and spring pressures is located by referring a reference number, given in the text, to the same number given in the appropriate "Fits and Clearances". In locations where no specific torque limit is given in "Fits and Clearances" the general torque recommendations are specified.

B. Terms and Symbols

(1) The terms and symbols used in "Fits and Clearances" are explained as follows:

(a) REF. DIMENSIONS Column - This column indicates the minimum and maximum manufacturing dimensions of two mating parts. These dimensions are provided for information only.

(b) LIMITS Column - This column indicates the desired minimum and maximum fits and clearances between new parts, and also the allowable limit to which these parts may wear before replacement is necessary (Ref. NOTES).

(c) The symbol T indicates a tight fit. The symbol L, or no letter after a fit denotes a loose fit.

(d) Unless otherwise specified, all fits are diametrical.

(e) The figures in the MINIMUM, MAXIMUM and REPLACE columns shall be interpreted as follows:

1 Imperial: Torque in pound-inches, spring pressures in pounds, and all other limits in inches.

2 Metric: Torque in newton-meters, spring pressures in newtons, and all other limits in millimeters.

NOTE: 1. Where the replace column is left blank, the minimum or maximum limit applies, as required.

NOTE: 2. Where minimum and maximum figures are given for torque loads, they represent the intended tightening range.

6. Standard Torques

A. General

(1) Torque limits are to be interpreted as follows:

(a) Torque values in pound-inches at room temperature.

(b) Angles of turn in degrees.

(c) Stretch values in inches.

(2) Unless otherwise specified, thread lubricant shall be engine oil and shall be applied to parts which are to be torqued.

(3) If the part to be tightened is hot, allow sufficient time for the part to reach temperature equilibrium with the surrounding area before final torquing.

(4) Flange bolts shall be drawn up evenly. This can be achieved by having two mechanics working simultaneously 180 degrees apart.

(5) Torque applications should be done slowly and evenly for consistency and the best possible accuracy.

(6) Check for re-use of self-locking fasteners as follows:

(a) Check for adequate torque of self-locking fasteners before re-use. Discard fastener if locking capability is impaired. Do not repair self-locking fasteners.

(b) Self-locking nuts, self-locking bolts, and self-locking helical coil inserts shall be capable of meeting torque requirements in Table 201.

TABLE 201, Torque Check for Reuse of Self-Locking Nuts, Bolts and Helical Coil Inserts (Pound-inches at Room Temperature and Lubricated With Engine Oil)

Fine Thread Mating Bolt Thread Size	Fine Thread Max Locking Torque	Fine Thread Min Break-away Torque	Course Thread Mating Bolt Thread Size	Course Thread Max Locking Torque	Course Thread Min Break-away Torque
0.112-48NF-2A	3	0.5	0.112-40NC-2A	3	0.5
0.138-40NF-2A	6	1.0	0.125-40NC-2A	4	1.0
0.164-36NF-2A	9	1.5	0.138-32NC-2A	6	1.0
0.190-32UNF-3A	13	2.0	0.164-32NC-2A	9	1.5
0.250-28UNF-3A	30	3.5	0.190-24UNC-3A	13	2.0
0.3125-24UNF-3A	60	6.5	0.250-20UNC-3A	30	4.5
0.375-24UNF-3A	80	9.5	0.3125-18UNC-3A	60	7.5
0.4375-20UNF-3A	100	14.0	0.375-16UNC-3A	80	12.0
0.500-20UNF-3A	150	18.0	0.4375-14UNC-3A	100	16.5
0.5625-18UNF-3A	200	24.0	0.500-14UNC-3A	150	24.0
0.625-18UNF-3A	300	32.0	0.5625-12UNC-3A	200	30.0
0.750-16UNF-3A	400	50.0	0.625-11UNC-3A	300	40.0
0.875-14UNF-3A	600	70.0	0.750-10UNC-3A	400	60.0
1.000-14UNF-3A	800	92.0	0.875- 9UNC-3A	600	82.0

TABLE 201, Torque Check for Reuse of Self-Locking Nuts, Bolts and Helical Coil Inserts (Pound-inches at Room Temperature and Lubricated With Engine Oil) (Cont'd)

Fine Thread Mating Bolt Thread Size	Fine Thread Max Locking Torque	Fine Thread Min Break-away Torque	Course Thread Mating Bolt Thread Size	Course Thread Max Locking Torque	Course Thread Min Break-away Torque
1.125-12UNF-3A	900	117.0	1.000- 8UNC-3A	800	110.0
1.250-12UNF-3A	1000	143.0	1.125- 8UNC-3A	900	137.0

NOTE: * Installation or removal.

NOTE: ** Use the listed bolt sizes for torque testing cadmium plated nuts, carbon steel nuts, alloy steel nuts, and aluminum nuts.

(c) The expression FIT TO is used when an operation may be required at assembly to obtain the required fit.

(d) An asterisk (*) in the replace column indicates that parts should be replaced if any looseness is found.

(e) The number symbol (#) indicates that parts should be replaced when scuffing, pitting, galling or excessive wear has taken place.

(f) Spline fits are calculated from chordal dimensions; unless otherwise specified, all other fits are diametrical.

(g) For torque testing stainless steel, corrosion and heat resistant steel, nickel alloy, and AMS6304 nuts, major, minor and pitch diameters of bolts should be reduced 0.003 inch below dimensions specified for listed 0.190-32 UNF-3A, 0.190-24 UNC-3A and larger bolt sizes (Ref. Table 201).

(h) Unplated Nuts

1 Unplated stainless steel, corrosion resistant steel, nickel alloy, and AMS6304 steel nuts that have threads overcut for plating at assembly, shall be silver plated 0.0003 to 0.0006 inch thick for test purposes, and checked for requirements as given in Table 201 for threaded unplated bolts.

NOTE: Where a non-standard torque value is specified, refer to fits and clearances in applicable chapter.

7. Torque Indicating Devices

A. General

(1) Check torque indicating devices before using, and calibrate by means of weights and a measured lever arm to make sure that there are no inaccuracies. Checking one torque wrench against another is not sufficient. Some wrenches are quite sensitive to the way they are supported during a tightening operation, and every effort must be made to adhere to the instructions furnished by the respective manufacturers.

B. Torque Wrench and Extensions

(1) Occasionally, it is necessary to use a special extension, or adapter wrench together with a standard torque wrench (Ref. Fig. 201). In order to arrive at the resultant required torque limits, the following formula shall be used:

T - Desired torque on the part.

E - Effective length of special extension or adapter.

L - Effective length of torque wrench.

A - Distance through which force is applied to part.

R - Reading on scale or dial of torque wrench.

$$R = \frac{LT}{A} = \frac{LT}{L + E}$$

Example:

A torque of 1440 lb.in. (162.698 Nm) is desired on a part, using special extension having a length of three inches (76.2 mm) from center to center of its holes, and a torque wrench measuring 15 inches (381 mm) from center of handle or handle swivel pin to center of its square adapter. Then:

$$R = \frac{LT}{L + E} = \frac{15 \times 1440}{15 + 3} = 1200 \text{ lb.in.}$$

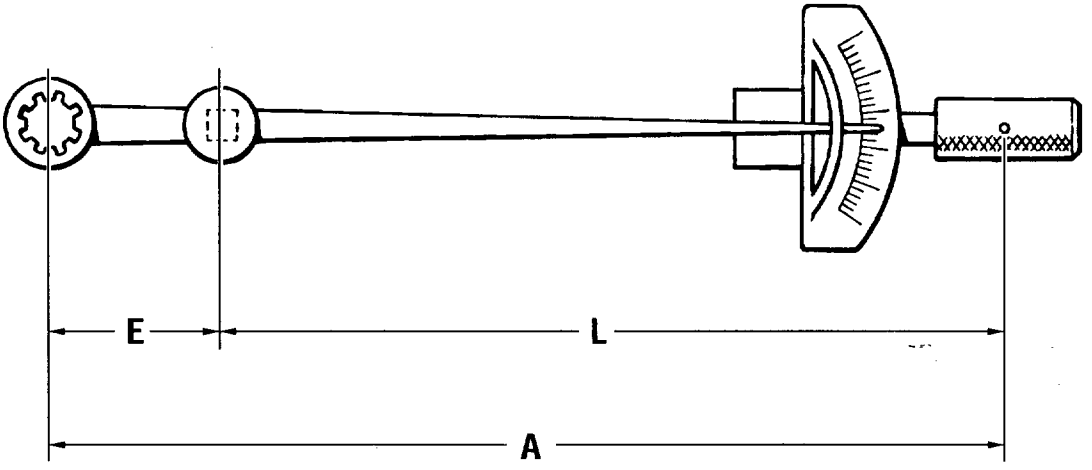
$$R = \frac{LT}{L + E} = \frac{381 \times 162.698}{381 + 76.2} = 135.582 \text{ Nm}$$

(a) With the axis of the extension or adapter and the torque wrench in a straight line, tightening to a wrench reading of 1200 lb.in. (135.582 Nm) will provide the desired torque of 1440 lb.in. (162.698 Nm) on the part.

8. Torque Recommendations

A. General

(1) All nut, bolt and screw torques should be obtained using a thread lubricant. The lubricant should be engine oil, or equivalent, unless otherwise specified. Torque requirements for interference fit application, such as studs and pipe plugs, may be obtained with or without lubrication, unless otherwise specified.



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Torque Wrench and Extension
Figure 201

B. Antiseize Lubricated Parts

CAUTION: ENSURE THAT ANTISEIZE AND ANTIGALLING COMPOUNDS ARE APPLIED IN A THIN EVEN COAT, AND THAT EXCESS COMPOUND IS COMPLETELY REMOVED TO AVOID CONTAMINATION OF ADJACENT PARTS, PASSAGES OR SURFACES WHERE THE COMPOUND MAY CAUSE MALFUNCTIONING, OR EVEN FAILURE, OF ENGINE.

(1) Antigalling compound (PWC06-001) should be applied to all loose-fit spline drives which are external to the engine and have no other means of lubrication. For certain assembly procedures molybdenum disulfide in either paste form (Type G) (PWC06-004) or powdered form (Type Z) (PWC06-004B) mixed with engine oil (PWC03-001) or grease (PWC04-001) may be used. Particular applications of molybdenum disulfide are indicated in the individual text portions of this manual, as applicable.

C. Nuts, Bolts and Screws

(1) Bolts and nuts on flanges with metal tabular gaskets must be initially torqued to the required torque and then retorqued until torque values given in relevant assembly instruction remain constant.

(2) The torque values given within text apply to nuts where the height of the nut is approximately equal to the major diameter of the thread. For jam nuts (Ref. to REMOVAL/INSTALLATION). Values do not apply to hollow bolts and screws.

D. Self-locking Nuts

(1) Where self-locking nuts and helical coil inserts are used, the following procedure applies:

(a) The locking torque for self-locking nuts and helical coil inserts must be checked at assembly. The locking torque must not be less than the values shown in Table 202 unless otherwise specified.

TABLE 202, Locking Torque for Self-locking Nuts and Helical Coil Inserts

Thread Size	Torque lb.in. Min
0.112-40	0.5
0.112-48	0.5
0.138-32	1.0
0.164-32	1.5
0.164-36	1.5
0.190-24	2.0
0.190-32	2.0
0.2500-20	4.5
0.2500-28	3.5
0.3125-18	7.5
0.3125-24	6.5
0.3750-16	12.0
0.3750-24	9.5
0.4375-14	16.5
0.4375-20	14.0
0.5000-13	24.0
0.5000-20	18.0
0.5625-12	30.0
0.5625-18	24.0
0.6250-11	40.0
0.6250-18	32.0
0.750-10	60.0
0.750-16	50.0
0.875-9	82.0
0.875-14	70.0
1.000-8	110.0
1.000-12	90.0

(b) When checking self-locking torque, care must be taken to ensure the fastener is not seated. This ensures that only the torque necessary to overcome the friction holding the thread is measured.

E. Lockwire and Cotterpin Requirements

(1) When tightening a castellated nut, alignment of slot must be obtained without exceeding the maximum torque. If this is not possible, replace nut with another one. After tightening nut to recommended torque, nut must not be loosened to permit insertion of lockwire or cotterpin. If slot in nut or lockwire hole in bolt or screw is not correctly aligned at the minimum torque value given, the nut, screw or bolt should be further tightened to next alignment position, but maximum torque value given must not be exceeded. Should alignment still be impossible without exceeding maximum torque, back off nut, screw or bolt one-half turn and retorque.

F. Slotted, Steel Locknuts (Prevailing Torque Type)

(1) Effective locking of slotted, steel locknuts on bolts or studs requires full engagement of all locknut threads. The chamfered section of the locknut ID does not exert force on the bolt or stud; therefore, it is not necessary that the bolt or stud be flush with, or protrude from, the outer face of the locknut.

G. Standard and Stepped Studs

(1) When the torque required to drive a stud to the correct protrusion does not reach the minimum value given, or exceeds the maximum value given, a new stud must be selected.

H. Hose, Tubing and Threaded Couplings

(1) If leakage occurs at a coupling, do not attempt to correct by overtorquing. Disassemble fitting and check for nicks, burrs and/or foreign matter. Use new parts to rectify.

9. Locking Devices

A. Keywashers (Tab and Cup Type) (Ref. Fig. 202)

CAUTION: KEYWASHERS ARE TO BE USED ONCE ONLY. INSTALL NEW KEYWASHER(S) AT EACH ASSEMBLY.

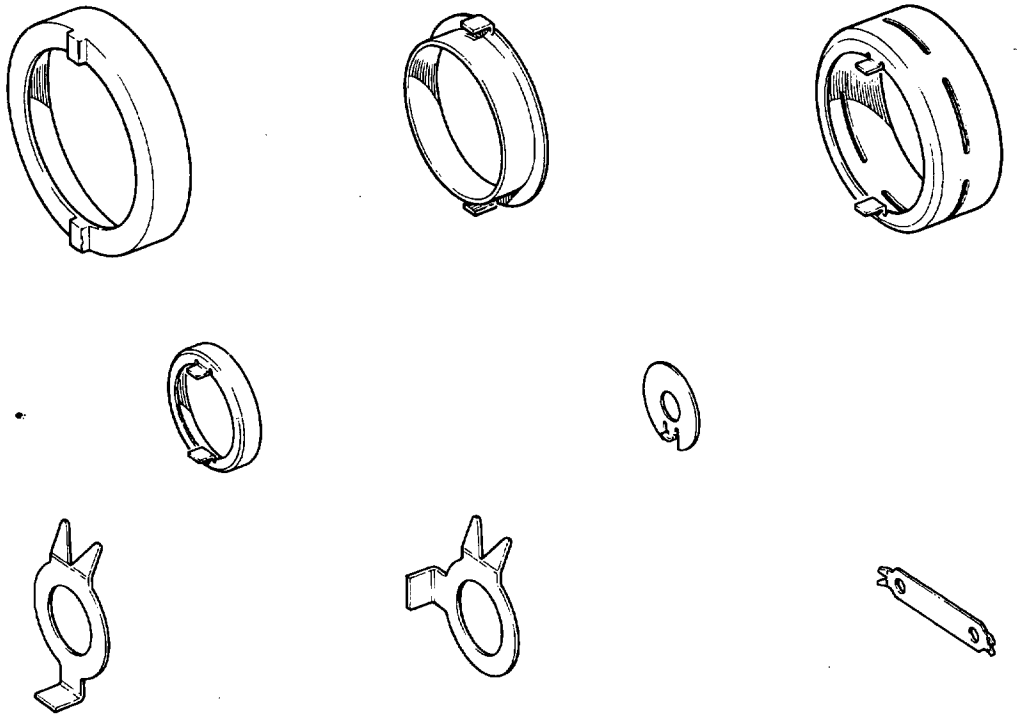
CAUTION: DO NOT USE SHARP EDGED TOOLS TO BEND OR SET KEYWASHER TABS. TAB DETACHMENT MAY OCCUR WITH SUBSEQUENT DAMAGE TO ENGINE.

(1) Pre-Assembly Requirements for Cupwashers:

(a) Visually inspect cupwasher for freedom from deep drawing score marks (especially in undercut adjacent to tangs) and for freedom from prior assembly/handling damage, i.e. bent tangs or prior stake marks.

(b) Visually inspect contact surfaces for excessive roughness, burrs, or scores that may cause the washer to bend on the nut.

(c) Visually inspect the nut for burrs, nicks or scratches on face which abuts the cupwasher that could cause the nut to pick up on the washer.



C2202

Examples of Lockwashers
Figure 202

(2) Assembly Requirements for Cupwashers:

(a) The cupwasher must be lubricated on the nut side only, the opposite face must be clean and dry.

(b) With cupwasher placed against shaft slots opposite to direction of nut tightening, screw nut fingertight.

(c) With a silver pencil, make an alignment mark on cupwasher outside diameter and the component immediately adjacent to cupwasher.

(d) Torque the nut in the normal manner.

(e) If alignment mark has moved, remove and discard cupwasher.

(f) Repeat procedure with new cupwasher.

(g) Stake cupwasher.

B. Retaining Rings

CAUTION: THOROUGHLY INSPECT ALL RETAINING RINGS, INCLUDING SPIROLOX, FOR CONDITION. DISTORTED RINGS ARE NOT ACCEPTABLE AND MUST BE REPLACED.

(1) Retaining rings must be installed using approved retaining ring pliers. Internal type rings must not be compressed beyond the point where the ends of the ring meet. External type rings must be expanded just enough to allow installation without becoming bent. After installation, ensure that each ring is completely seated, without looseness or distortion in its groove.

C. Lockwire

(1) Except where otherwise specified, the wire is heat and corrosion resistant steel wire of 0.025 inch diameter (PWC05-089).

(2) Basic Rules

(a) Lockwire must be tight after installation to prevent failure due to rubbing or vibration.

(b) Lockwire must be installed in a manner that tends to tighten and keep a part locked in place thus counteracting the natural tendency of the part to loosen.

(c) Lockwire must never be overstressed. It will break under vibrations if twisted too tightly. The lockwire shall be pulled taut when being twisted, but shall have minimum tension, if any when secured.

(d) Lockwire ends must be bent toward the engine, or part, to avoid sharp or projecting ends which might present a safety hazard or vibrate in the air stream.

(e) Internal wiring must not cross over or obstruct a flow passage when an alternate method can be used.

(2) Lockwire Hole Alignment

(a) Check the units to be lockwired to make sure they have been correctly torqued and that the wiring holes are properly positioned in relation to each other. When there are two or more units, it is desirable that the holes in the units be in the same relationship to each other. Never overtorque or loosen units to obtain proper alignment of the holes. It should be possible to align the wiring holes when the units are torqued within the specified limits. However, if it is impossible to obtain a proper alignment of the holes without either over or under torquing, select another unit which will permit proper alignment within the specified torque limits.

(3) Lockwire Twisting

(a) To prevent mutilations of the twisted section of the wire when using pliers, grasp the wire at the ends or at a point that will not be twisted. Lockwire must not be nicked, kinked, or mutilated. Never twist the wire ends off with the pliers and when cutting off ends, leave at least three complete turns after the loop, exercising extreme care to prevent the wire ends from falling into the engine. The strength of the lockwire holes is marginal; never twist the wire off with pliers. Cut the lockwire close to the hole, exercising extreme care.

(4) Lockwire Illustrations

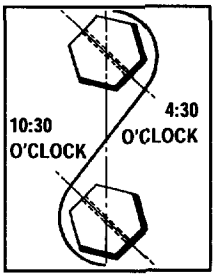
(a) Figure 203 illustrates a typical lockwiring procedure. Although there are numerous lockwiring operations performed on these engines, practically all are derived from the basic examples shown in Figure 204.

10. Identification of Hardware Material, Particularly Nuts and Bolts

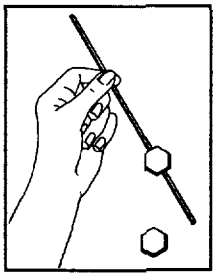
A. A permanent type of material code designation has been adopted for use in these engines. Correct engine reassembly procedures require that particular attention be paid to the material requirements for nuts and bolts used in the hot section of the engine. In these areas, where parts must be of material which is resistant to high operating temperatures, special heat resistant alloys are employed. It is imperative that at reassembly of the engine or its components the properly coded part be reassembled in its original location, if serviceable.

B. The code system employs the use of a letter "C" for corrosion resistant steel for normal application and "H" for heat resistant alloys in hot section application. The stamped or embossed letter will be followed by a number of one or more digits, such as C1, C8, H3, and H12. Bolt code identification will usually appear on the top of the head and nut identification on one side of the hex (Ref. Fig. 205). When the application is an AN or MS six digit part number, the code identification "C" or "H" will be preceded by the letter "E" as in EC3 or EH10.

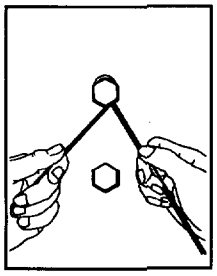
NOTE: All AN or MS six digit part numbers, when manufactured of material in the common temperature range (such as cadmium plated, low alloy steel parts), are also coded "E" to indicate, in part, close material quality control.



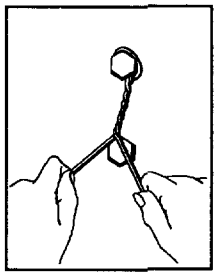
POSITION THE HOLES.



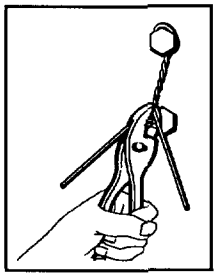
INSERT PROPER GAGE WIRE.



GRASP UPPER END OF THE WIRE AND BEND IT AROUND THE HEAD OF THE BOLT, THEN UNDER THE OTHER END OF THE WIRE. BE SURE WIRE IS TIGHT AROUND HEAD.

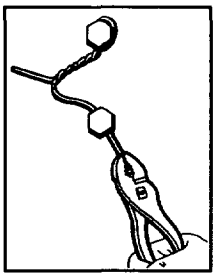


TWIST WIRE UNTIL WIRE IS JUST SHORT OF HOLE IN THE SECOND BOLT.

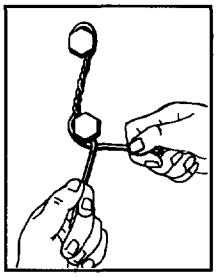


KEEPING WIRE UNDER TENSION, TWIST IN A CLOCKWISE DIRECTION UNTIL THE WIRE IS TIGHT. WHEN TIGHTENED THE WIRE SHALL HAVE APPROXIMATELY 7 TO 10 TWISTS PER INCH.

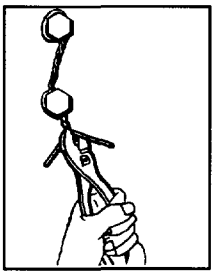
INSERT THE UPPERMOST WIRE, WHICH POINTS TOWARDS THE SECOND BOLT, THROUGH THE HOLE WHICH LIES BETWEEN THE NINE AND TWELVE O'CLOCK POSITIONS. GRASP THE END OF THE WIRE WITH A PAIR OF PLIERS AND PULL THE WIRE TIGHT.



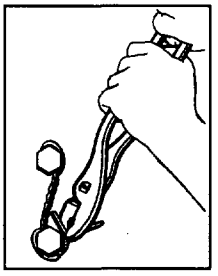
BRING THE FREE END OF THE WIRE AROUND THE BOLT HEAD IN A COUNTERCLOCKWISE DIRECTION AND UNDER THE END PROTRUDING FROM THE BOLT HOLE. TWIST THE WIRE IN A COUNTERCLOCKWISE DIRECTION.



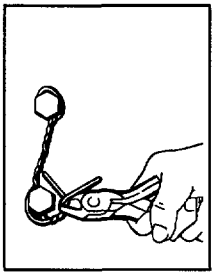
GRASP THE WIRE BEYOND THE TWISTED PORTION AND TWIST THE WIRE ENDS COUNTERCLOCKWISE UNTIL TIGHT.



DURING THE FINAL TWISTING MOTION OF THE PLIERS, BEND THE WIRE DOWN AND UNDER THE HEAD OF THE BOLT.

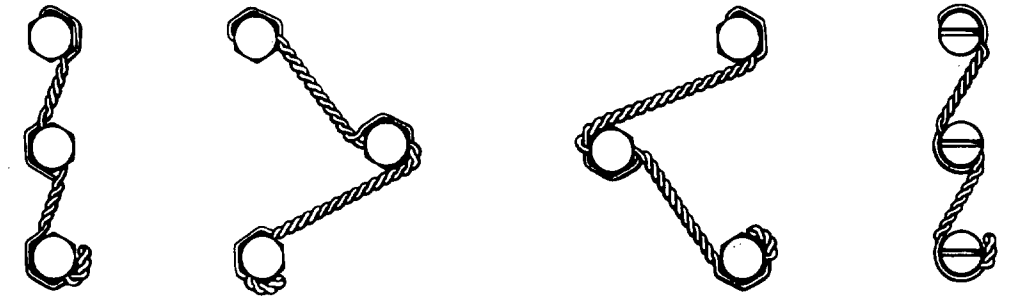


CUT OFF EXCESS WIRE WITH DIAGONAL CUTTERS.



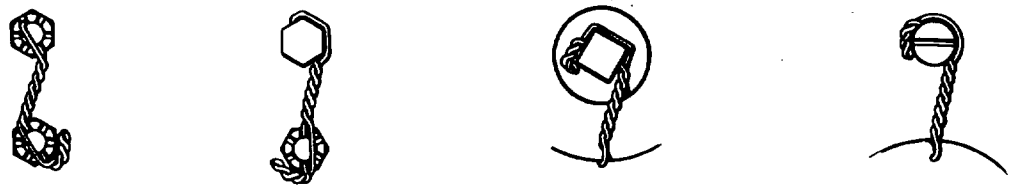
C194C

Lockwiring Procedure
Figure 203



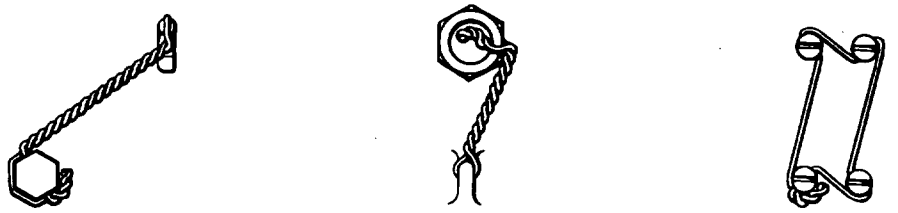
EXAMPLE 1 EXAMPLE 2 EXAMPLE 3 EXAMPLE 4

EXAMPLES 1,2,3 AND 4 APPLY TO ALL TYPES OF BOLTS, FILLISTER HEAD SCREWS, SQUARE HEAD PLUGS, AND OTHER SIMILAR PARTS WHICH ARE WIRED SO THAT THE LOOSENING TENDENCY OF EITHER PART IS COUNTERACTED BY TIGHTENING OF THE OTHER PART. THE DIRECTION OF TWIST, FROM THE SECOND TO THE THIRD UNIT, IS COUNTER-CLOCKWISE TO KEEP THE LOOP IN POSITION AGAINST THE HEAD OF THE BOLT. THE WIRE ENTERING THE HOLE IN THE THIRD UNIT WILL BE THE LOWER WIRE AND BY MAKING A COUNTER-CLOCKWISE TWIST AFTER IT LEAVES THE HOLE, THE LOOP WILL BE SECURED IN PLACE AROUND THE HEAD OF THAT BOLT.



EXAMPLE 5 EXAMPLE 6 EXAMPLE 7 EXAMPLE 8

EXAMPLES 5,6,7 AND 8 SHOW METHODS FOR WIRING VARIOUS STANDARD ITEMS. WIRE MAY BE WRAPPED OVER THE UNIT RATHER THAN AROUND IT WHEN WIRING CASTELLATED NUTS OR ON OTHER ITEMS WHEN THERE IS A CLEARANCE PROBLEM.



EXAMPLE 9

EXAMPLE 9 SHOWS THE METHOD FOR WIRING BOLTS IN DIFFERENT PLANES. NOTE THAT WIRE SHOULD ALWAYS BE APPLIED SO THAT TENSION IS IN THE TIGHTENING DIRECTION.

EXAMPLE 10

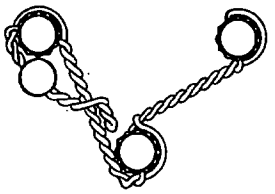
EXAMPLE 10 SHOWS HOLLOW HEAD PLUGS WIRED WITH THE TAB BENT INSIDE THE HOLE TO AVOID SNAGS AND POSSIBLE INJURY TO PERSONNEL WORKING ON THE ENGINE.

EXAMPLE 11

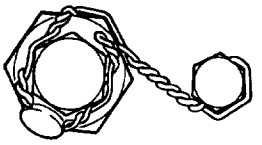
EXAMPLE 11 SHOWS CORRECT APPLICATION OF SINGLE WIRE TO CLOSELY SPACED MULTIPLE GROUP.

C195_1

Lockwiring Examples
Figure 204 (Sheet 1 of 3)



EXAMPLE 12

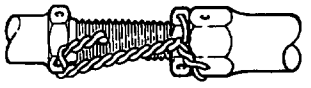


EXAMPLE 13

EXAMPLES 12 AND 13 SHOW METHODS FOR ATTACHING LEAD SEAL TO PROTECT CRITICAL ADJUSTMENTS.

EXAMPLE 14

EXAMPLE 14 SHOWS BOLT WIRED TO A RIGHT ANGLE BRACKET WITH THE WIRE WRAPPED AROUND THE BRACKET.

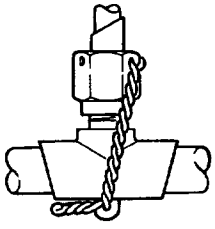


EXAMPLE 15

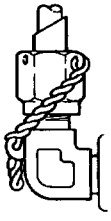
EXAMPLE 15 SHOWS CORRECT METHOD FOR WIRING ADJUSTABLE CONNECTING ROD.

EXAMPLE 16

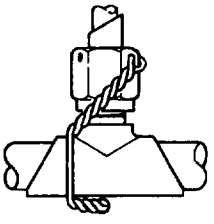
EXAMPLE 16 SHOWS CORRECT METHOD FOR WIRING THE COUPLING NUT ON FLEXIBLE LINE TO THE STRAIGHT CONNECTOR BRAZED ON RIGID TUBE.



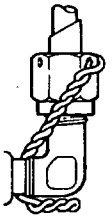
EXAMPLE 17



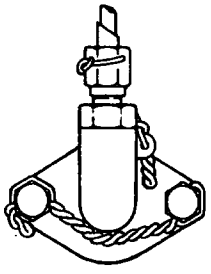
EXAMPLE 18



EXAMPLE 19



EXAMPLE 20



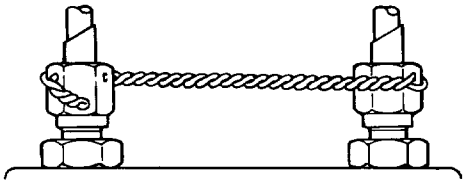
EXAMPLE 21

FITTINGS INCORPORATING WIRE LUGS SHALL BE WIRED AS SHOWN IN EXAMPLES 17 AND 18. WHERE NO LOCKWIRE LUG IS PROVIDED, WIRE SHOULD BE APPLIED AS SHOWN IN EXAMPLES 19 AND 20 WITH CAUTION BEING EXERTED TO ENSURE THAT WIRE IS WRAPPED TIGHTLY AROUND THE FITTING.

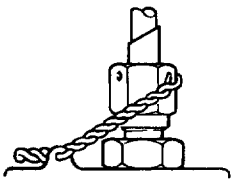
SMALL SIZE COUPLING NUTS SHALL BE WIRED BY WRAPPING THE WIRE AROUND THE NUT AND INSERTING IT THROUGH THE HOLES AS SHOWN.

C195_2

Lockwiring Examples
Figure 204 (Sheet 2)

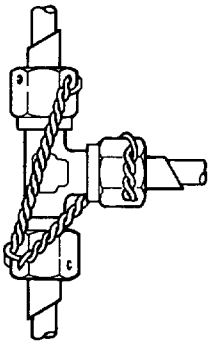


EXAMPLE 22



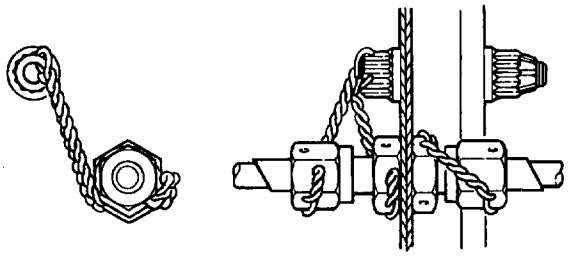
EXAMPLE 23

COUPLING NUTS ATTACHED TO STRAIGHT CONNECTORS SHALL BE WIRED AS SHOWN WHEN HEX IS AN INTEGRAL PART OF THE CONNECTOR.



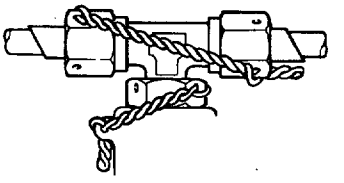
EXAMPLE 24

COUPLING NUTS ON A TEE SHALL BE WIRED AS SHOWN ABOVE SO THAT TENSION IS ALWAYS IN THE TIGHTENING DIRECTION.

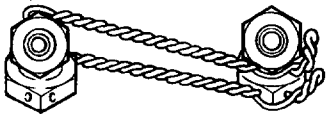


EXAMPLE 25

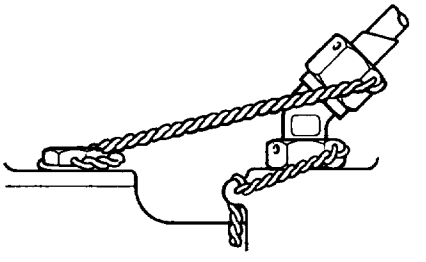
STRAIGHT CONNECTOR
(BULKHEAD TYPE)



EXAMPLE 26



EXAMPLE 27

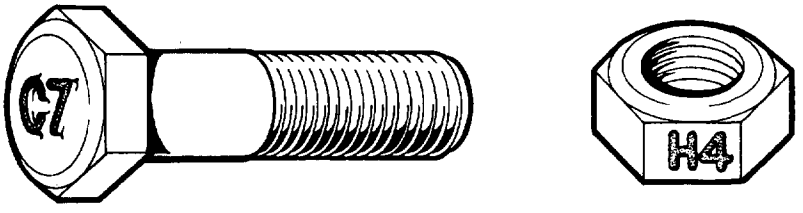


EXAMPLE 28

EXAMPLES 26, 27 AND 28 SHOW THE VARIOUS STANDARD FITTINGS WITH CHECK NUT WIRED SO THAT IT NEED NOT BE DISTURBED WHEN REMOVING THE COUPLING NUT.

C195_3

Lockwiring Examples
Figure 204 (Sheet 3)



C196

Hardware Code Identification
Figure 205

C. The adoption of this program will make it possible for service activities to avoid the assembly of parts, with similar physical appearance, in locations which require high heat resistant parts. In this regard, it is required, at time of disassembly (removal), that all similarly coded parts be segregated so that two, or more, physically similar parts with different code numbers will not be scrambled; and so that, at subsequent reassembly (installation), the properly coded parts are replaced in their proper locations.

CAUTION: NEVER ASSEMBLE A MATERIAL CODED PART WITH A "C" IDENTIFICATION IN A LOCATION WHICH REQUIRES AN "H" CODED PART AND VICE-VERSA. NEVER USE CADMIUM PLATED NUTS, BOLTS OR ANY OTHER CADMIUM PLATED PART IN THE HOT SECTION OF THE ENGINE.

D. Parts from several engines should not be scrambled at disassembly (removal) and cleaning, because, at the time of engine manufacture, production requirements may necessitate one or more material substitutions in a block of engines. Subsequent engine reassembly with indiscriminate scrambling of hardware, may result in unnecessary confusion in sorting these parts for proper reassembly.

CAUTION: IT IS IMPORTANT THAT "J" THREADED HARDWARE BE CAREFULLY SEGREGATED AND MARKED AT DISASSEMBLY (REMOVAL) TO PREVENT MIXING OF "J" THREADED PARTS WITH NON "J" THREADED PARTS.

E. Unified Controlled Radius Root "J" Threaded Bolts feature full root radius for external threads with increased minor internal threaded diameter. "J" threads ensure greater fatigue life, improved stress relaxation characteristics and show improvement in tensile strength over previous designs. This thread form is used extensively throughout engines. Engine bolts having "J" threads appear just like items threaded with conventional threads.

11. Stainless Steel Bolts with Reduced Pitch Diameters

At engine manufacture, it is the practice to provide bolts with reduced pitch diameter for use in the hot sections of engines. This will minimize the possibility of bolt and nut seizure and is standard practice for locations where the parts are subjected to elevated temperatures (Ref. Fig. 206).

12. Identification of Metal Particles

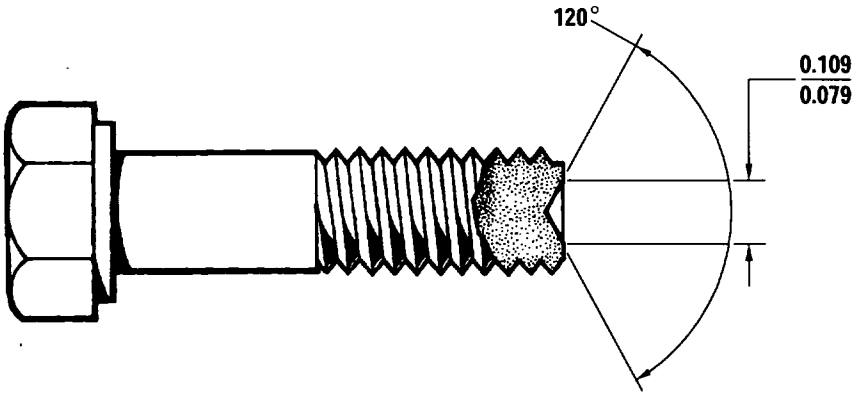
A. General

(1) When unidentified particles of metal are found, they may be either steel, tin, aluminum, magnesium, silver, bronze, titanium, or cadmium. In some cases the type of metal may be determined by the color and hardness of the pieces. However, when the particles cannot be positively identified by visual inspection and knowledge of the exact character of the metal is desired as an aid to troubleshooting, a few simple tests will determine the kind of metal present.

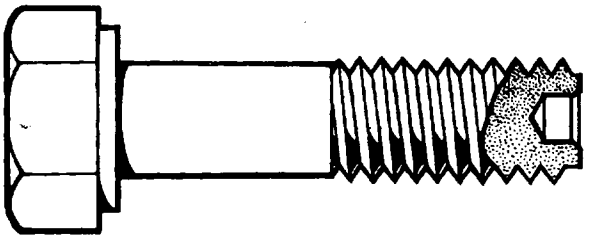
WARNING: USE EXTREME CARE IN HANDLING ACIDS.

(2) The following equipment and chemicals are required to make these tests:

- a source of open flame



REDUCED PITCH DIAMETER BOLT



STANDARD BOLT

C197B

Reduced Pitch Diameter Bolt Identification
Figure 206

- permanent magnet
- two ounces of aqueous solution containing ten percent ammonium nitrate
- electrical soldering iron
- two ounces each of 50 percent by volume hydrochloric acid (PWC05-196) and concentrated nitric acid (PWC05-195)
- sodium hydroxide pellets (PWC05-056)
- watch glass
- white porcelain spot plate
- ammonium biflouride crystals (PWC05-009)
- 5 to 10 percent hydrofluoric acid (PWC05-004) or concentrated sulfuric acid (PWC05-074)
- 3 to 10 percent hydrogen peroxide (PWC05-038)
- concentrated phosphoric acid (PWC05-006).

B. Test Procedure

NOTE: The following test procedure is recommended for determining the character of unknown metal particles. For best results, follow the steps as outlined:

(1) Steel - the particles of many steels can be isolated by means of the permanent magnet. Magnetic steel or iron is attracted by the magnet.

WARNING: NEVER ATTEMPT TO BURN MORE THAN A FEW PARTICLES OF METAL SUSPECTED TO BE MAGNESIUM POWDER. DUST IS EXPLOSIVE.

(2) Magnesium - a simple test for these particles is burning. Magnesium will burn with a bright white flash.

(3) Cadmium - place the remaining particles in the aqueous (water) solution of ammonium nitrate. If all or any of the particles dissolve in this solution, they are cadmium. After this test, rinse and dry any remaining particles.

(4) Tin - the tin particles can be distinguished by their low melting point. With a clean soldering iron, heated to 260°C (500°F) and tinned with 50-50 solder (50 percent tin - 50 percent lead), a tin particle dropped on the iron will melt and fuse with the solder.

(5) Aluminum - when a particle of aluminum is placed in hydrochloric acid, 50 percent by volume, it will fizz with rapid emission of gas bubbles and gradually disintegrate and form a black residue (aluminum chloride). Silver and bronze do not noticeably react with hydrochloric acid.

(6) Aluminum Paint - use this procedure to determine whether or not the material is aluminum silicone paint, aluminum chips, or silver particles.

(a) Make a sodium hydroxide solution by adding one pellet of sodium hydroxide to three cubic centimeters of water.

(b) Place several drops of this solution on a watch glass and drop in the suspected particles.

(c) If the particles are aluminum silicone paint, there will be a mild reaction in the form of gas bubbles and some visible gas as the particles change to sodium aluminate.

(d) If the particles are aluminum chips, the reaction will be much more active with many more gas bubbles forming and more visible gas.

(e) If the particles are silver, there will be no reaction.

(7) Silver - when a silver particle is placed in nitric acid, it reacts rather slowly, producing a whitish fog in the acid.

(8) Bronze - when a bronze (or copper) particle is placed in nitric acid, a bright green cloud is produced.

C. Test Procedure for Identification of Titanium Particles

WARNING: THE FOLLOWING CHEMICALS ARE HAZARDOUS AND REQUIRE SPECIAL HANDLING. IT IS RECOMMENDED THAT FOLLOWING TESTS BE CARRIED OUT BY QUALIFIED LABORATORY PERSONNEL.

(1) Place a piece, or pieces of the metal to be identified, on a white porcelain spot plate. A piece of titanium or titanium-bearing metal should be placed on another spot plate to observe and verify the results obtained.

(2) Add several crystals of ammonium bifluoride and 5 to 10 drops of water to the metal particles. (Two or three drops of a 5 to 10 percent hydrofluoric acid solution can be used instead).

NOTE: Solid ammonium bifluoride is crystaline and can be conveniently stored in a dry area and used as required.

(3) Let stand 20 to 30 minutes, or until the solution becomes slightly discolored.

(4) Add two or three drops of 1:1 sulfuric acid (one part demineralized water to one part concentrated acid).

(5) Let stand 20 to 30 minutes, or until solution becomes more discolored.

(6) Add three to four drops of 3 to 10 percent hydrogen peroxide. Solution must not be too old.

(7) If titanium is present, a yellowish color will develop. This yellow color will become progressively darker with time, if allowed to set.

(8) Add two to three drops of concentrated phosphoric acid, and stir to discharge any yellow color due to the possible presence of iron.

(9) Any light yellow to orange coloration indicates the presence of titanium.

13. Marking of Parts

A. General

Marking of engine parts, assemblies, or weldments shall be applied so as to ensure maximum legibility and durability of mark but in a manner that will not affect function or serviceability of part. Only applicable Pratt & Whitney Canada marking methods shall be used.

Except where otherwise specified, reidentification of parts shall be accomplished adjacent to, or in a location similar to that of, original marking.

All marking characters, unless otherwise specified, shall be 0.060 to 1.160 inch high. In special cases, when marking area is governed by size or configuration of part, characters not less than 0.016 inch nor more than 0.250 inch in height are permitted.

Electric-arc scribing, particularly hand arc scribing, whereby characters are produced by action of an electric arc between surface and an electrode (scriber), has been found unsuitable for jet engine parts and must not be used.

Acid etching, whereby characters are formed by action of an acid on surface of part, is not recommended because of its possible corrosive effect.

Soapstone shall not be used to mark engine parts.

B. Permanent Marking Methods

(1) General

(a) Marking should be done as close to original marking as possible. Permanent methods of marking are those in which marking is legible during entire service life of part.

(b) Permanent markings shall not extend onto any radius, chamfer, sharp edge, or fillet adjoining designated marking surface.

(2) Applied Marking Methods

CAUTION: DO NOT ELECTROLYTICALLY ETCH ANODIZED SURFACES.

(a) Electrolytic Etch - Characters are produced by electrolysis confined to area of characters by a stencil. This technique is sometimes used as a temporary method. Do not confuse it with electric-arc scribing.

(b) Vibration Peening - Characters are produced by a vibrating, radius-tipped, conical tool.

Manual - tool is hand-guided and has a single tip.

Mechanical - tool is mechanically guided and has a single tip, or has multiple tips producing one or more complete characters simultaneously. This method is not usually permitted if hardness of part at time of marking is higher than Rockwell C45 or equivalent. It may be used on parts harder than Rockwell C45 when specifically permitted.

NOTE: Vibration peening marking method can be substituted for marking parts originally marked by diamond drag or roll marking.

C. Temporary Marking Methods

(1) General

(a) Temporary methods of marking are those in which the marking will ensure identification during ordinary handling, and storage, and final assembly.

CAUTION: LEAD AND/OR METALLIC PENCILS, OR ANY TEMPORARY MARKING METHOD LEAVING A DETRIMENTAL DEPOSIT OF CARBON, ZINC, COPPER, LEAD, OR SIMILAR RESIDUE WHICH MAY CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN THE PART IS SUBJECTED TO INTENSE HEAT, SHALL NOT BE USED. IN THE EVENT THAT AN UNAUTHORIZED MARKING MATERIAL IS USED, THE MARK MUST BE THOROUGHLY REMOVED BY A PROCEDURE DICTATED BY THE MARKING METHOD AND THE PART MATERIAL.

(b) When using a marking pencil, marks shall not be applied to carbon seal plate surfaces or to mating surfaces of finished machined parts. Heavy deposits or marking material could adversely affect clearance and runout.

(2) Applied Marking Methods

CAUTION: ANODIZED SURFACES MUST NOT BE ELECTROLYTICALLY ETCHED.

(a) Electrolytic Etch - Characters are produced by electrolysis confined to area of characters by a stencil. This is primarily a permanent marking method. However, where specified, it may also be used for temporary marking.

(b) Ink Marking

1 Characters are produced by applying, by any means, an ink which does not injure the surface. Inks used in marking may have a light etching action, providing etching does not injure the surface.

NOTE: Ordinarily, ink stamping and electrolytic etching, when used as a temporary marking method, may be applied to any surface which, after assembly, does not move relative to a contacting surface.

(3) Marking Materials, Hot and Cold Section Engine Parts

(a) Felt Wick Pen and Speedry Instant Dry Ink.

(b) Marks-A-Lot Marker.

(c) Brushpen No. 57 and Tex-Rite Instant Dry Ink.

Ink Types:

400-1 (Black)
400-2 (Red)
400-7 (Purple)

(d) Micro Supreme No. 142 (Purple Dye).

(e) Phano No. 71 Red Pencil. May be used on parts which are not directly exposed to the gas path. This type of mark is easily obliterated and, therefore, less durable.

(f) Eberhard Faber Colorbrite Silver No. 2101, or Joseph Dixon Best Silver No. 1936 pencils.

(4) Marking Materials, Cold Section Engine Parts Only

Volgers Opaque Ink (Black).
Dykem Ink KX425 (Black).
Dykem Ink KXX122 (White).
Carters Ink No. 451 (Black).

(5) Marking Materials, Hot Section Engine Parts Only. Use layout dye (lightly applied) to mark parts which are directly exposed to engine gas path such as turbine blades and disks, turbine vanes, and combustion chamber liner.

14. Lubrication of Preformed Packings

A. Procedure

CAUTION: APPLICATION OF LUBRICANT PLUS PROPER ASSEMBLY, WILL PREVENT DAMAGE TO PACKINGS WHICH COULD CAUSE ENGINE MALFUNCTION.

(1) Prior to installation, new O-ring type preformed packings must be coated with a thin film of lubricant to the following specifications:

(a) Packings used in engine oil and fuel systems, use engine oil (PWC03-001).

(b) Packings used in engine pneumatic system assemblies, use petrolatum (PWC06-002).

STANDARD PRACTICES - REMOVAL/INSTALLATION

1. General

A. Dust caps used to protect open tubes against contamination shall always be installed over the tube ends and not in the tube ends. Flow through the lines may be blocked off if lines are inadvertently installed with dust caps in the tube ends.

B. Install protective caps over the outside of electrical connectors. Do not install protective caps on the inside of electrical connector sleeves. Improper installation of cap can damage the inside of the connector (Ref. Fig. 402).

C. To ensure proper reinstallation, tag and mark all parts, clips, and brackets as to their location.

D. During removal of tubes or engine parts look for indications of scoring, burning or other undesirable conditions. To facilitate reinstallation, observe the location of each part during removal. Tag unserviceable parts and units for investigation and possible repair.

E. Extreme care shall be taken to prevent dust, dirt, lockwire, nuts, washers or other foreign matter from entering the engine. It cannot be overemphasized that this precaution applies whenever work is done on the engine either on the wing or off the wing. Suitable plugs, caps, and other covering shall be used to protect all openings as they are exposed.

F. If at any time items are dropped into the engine, the assembly process must stop until the dropped articles are located, even though this may require a considerable amount of time and labor. Before assembling or installing any part, be sure it is thoroughly clean.

G. Lockwire, lockwashers, tablocks, tabwashers, or cotterpins must never be reused. All lockwire and cotterpins must fit snugly in holes drilled in studs and bolts for locking purposes. Install a cotterpin so that the head fits into the castellation of the nut, and unless otherwise specified, bend one end of the pin back over the stud or bolt and the other end down flat against the nut. Only lockwire and cotterpins made of corrosion resistant steel shall be used. Bushing plugs shall be lockwired to the assembly boss or case. Do not lockwire the plug to the bushing.

H. Replace all gaskets, packings, and rubber parts at reassembly. Make sure that new nonmetallic parts to be installed (such as an oil seal) show no sign of having deteriorated in storage.

I. To protect critical areas of engine parts (such as compressor and turbine disks) against scratches and nicks, tool surfaces contacting these areas must be covered with protective material.

J. During replacement of components, note condition of any removed preformed packings. Pieces accidentally torn or cut from packings must be retrieved, regardless of size, even if this entails a systematic disassembly and cleaning of the system. Ensure that new packings are free of cuts, flashings and deformities which may be sheared off at installation.

K. When installing engine parts that require the use of a hammer to facilitate assembly or installation, use only a plastic or rawhide hammer.

L. Whenever adhesive tape has been applied to any part, the tape must be removed and the part thoroughly cleaned of all tape residue with petroleum solvent prior to being subjected to high temperature during engine run. Test results indicate that all tapes are capable of causing surface attack and/or reduction in tensile ductility as temperature increases. Do not leave tape or tape residue on engine parts.

M. If any part has been coated with corrosion preventive compounds, all traces of this compound and accumulated foreign matter must be removed.

2. Consumable Materials

The consumable materials listed below are used in the following procedures.

Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-105	Tape, Electrical Insulation
PWC06-002	Petrolatum, White

3. Special Tools

Not Applicable

4. Fixtures, Equipment and Supplier Tools

Not Applicable

5. Removal/Installation

CAUTION: DO NOT BEND, TWIST OR FORCE HYDRAULIC AND PNEUMATIC TUBES, WHETHER RIGID OR FLEXIBLE, TO ACHIEVE ALIGNMENT WITH MATING FITTING. ADJUST FITTING TO ALIGN WITH TUBE. CLAMP AND FASTEN TUBE ONLY WHEN IT IS INSTALLED IN POSITION WITH NO NOTICEABLE TENSION OR LOAD.

A. Removal of Straight Nipples, Straight Adapters, Bulkhead Couplings and Tube Connector Nipples

(1) Remove fittings from engine lines or accessory units.

(2) Remove preformed packings from fittings and discard.

B. Removal of Tube-to-Boss Elbows, Elbow Adapters and Elbow Assemblies

(1) Remove fittings from engine lines or accessory units.

NOTE: Before removal, note angular position of fitting on engine or unit.

(2) Remove preformed packings, packing retainers (back-up rings) and discard. Discard jam nuts from fittings.

C. Installation of Straight Nipples, Straight Adapters, Bulkhead Couplings and Tube Connector Nipples

(1) Lubricate new preformed packing with light film of engine oil (PWC03-001) or fluid to be used in line.

(2) Install preformed packing on fitting and screw fitting in boss or flange, as applicable.

CAUTION: EXCESSIVE TIGHTENING WILL RESULT IN DAMAGE TO THREADS OF MATING PARTS.

(3) Tighten fitting in boss and torque to value detailed in relevant assembly instruction.

(4) Install jam nut on flange mounted fittings and torque jam nut to recommended value (Ref. Table 401).

D. Installation of Tube-to-Boss Elbows, Elbow Adapters and Elbow Assemblies (Ref. Fig. 401)

(1) Lubricate new preformed packings, packing retainer (back-up ring) and thread of elbow fitting with light film of petrolatum (PWC06-002) or fluid to be used in the line.

TABLE 401, Torque Values for Jam Nuts

Thread Size	Torque (lb.in.)
0.250 -28	14 to 16
0.3125-24	22 to 24
0.375 -24	28 to 32
0.4375-20	38 to 42
0.500 -20	58 to 62
0.5625-18	70 to 80
0.625 -18	95 to 105
0.750 -16	145 to 155
0.8125-16	165 to 185

(2) Assemble jam nut, new packing retainer and preformed packing on elbow fitting, pressing packing retainer into counterbore of jam nut.

(3) Turn jam nut down elbow fitting until preformed packing is seated in non-threaded annulus of fitting.

(4) Turn jam nut outward until preformed packing is pushed firmly against first lower thread of fitting.

(5) Install elbow fitting into boss on unit, allowing jam nut to turn with fitting until preformed packing contacts boss mating face. This point will be recognized by increase in torque.

(6) With fitting in this position, hold jam nut stationary and turn elbow fitting into boss a further 1½ turns.

NOTE: From this position the elbow fitting may be further turned inward to a maximum of one turn to facilitate alignment of fitting. Should the fitting tighten in the jam nut before completion of initial 1½ turns or during final alignment, the jam nut may be allowed to turn with the fitting for the remainder of the distance.

(7) With elbow fitting in correct alignment position, tighten jam nut and torque to recommended torque (Ref. Table 401).

NOTE: Metal-to-metal contact between jam nut and boss must be obtained without exceeding recommended torque and there must be no extrusion of preformed packing or packing retainer.

E. Electrical Connectors (Ref. Figs. 402 and 403)

CAUTION: INSTALL PROTECTIVE CAPS OVER THE OUTSIDE OF ELECTRICAL CONNECTORS. DO NOT INSTALL PROTECTIVE CAPS ON THE INSIDE OF ELECTRICAL CONNECTOR SLEEVES. IMPROPER INSTALLATION OF CAP CAN DAMAGE THE INSIDE OF THE CONNECTOR.

(1) Install protective plastic caps on all electrical connectors removed from components or engine (Ref. Fig. 402).

(2) Post-SB24507 or Post-SB24372:

(a) For straight connectors, apply electrical insulation tape (PWC05-105) from the body of the receptacle to the backshell of the wiring harness connector as shown. The tape must be stretched during this application and remain tight.

(b) For 90 degree connectors, apply electrical insulation tape (PWC05-105) from the body of the receptacle to a length of approximately 0.750 inches. The tape must be stretched during this application and remain tight.

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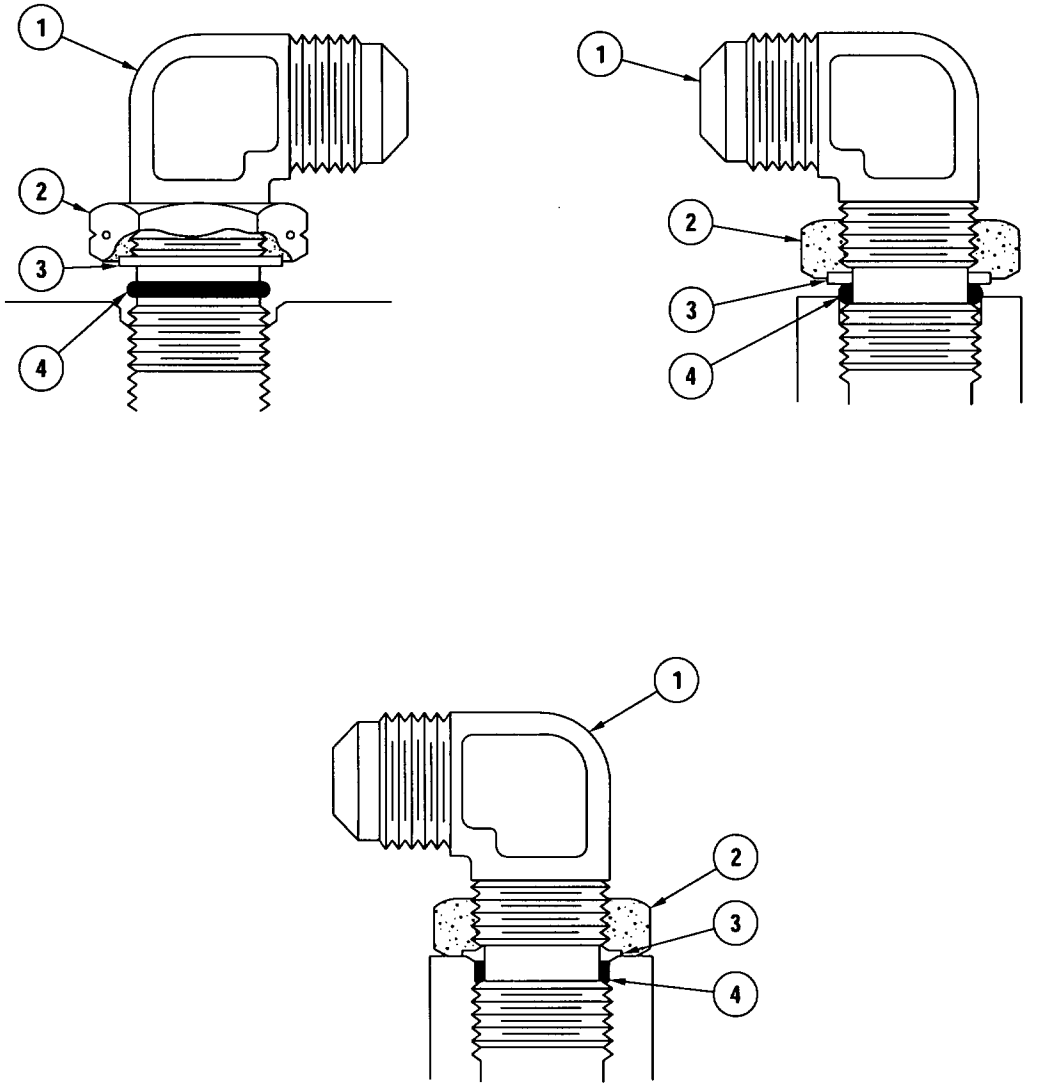
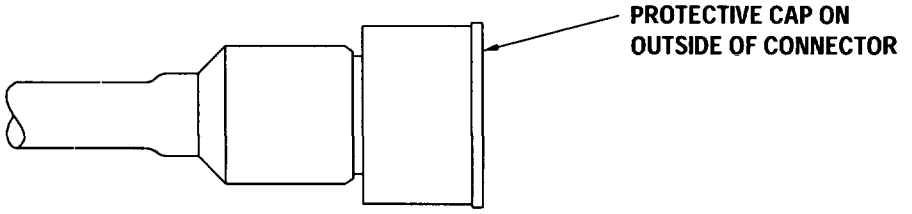


C3146A

Installation of Typical Elbow Fitting
Figure 401

Key to Figure 401

1. Elbow Fitting
2. Jam Nut
3. Packing Retainer
4. Preformed Packing



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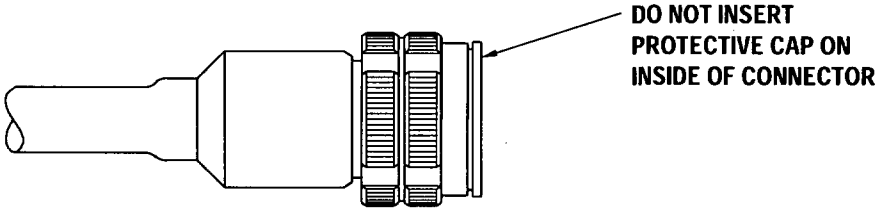

INCORRECT

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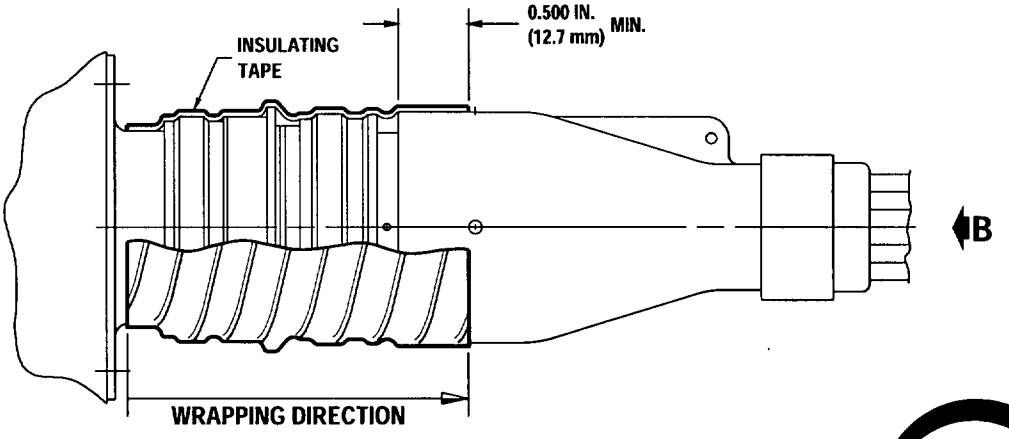
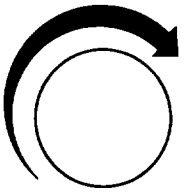
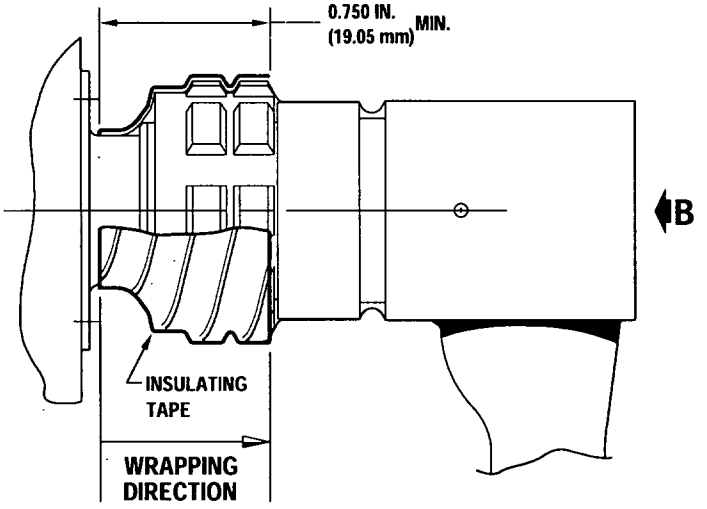
Installation of Protective Caps on Electrical Connectors
Figure 402



TYPICAL VIEW OF STRAIGHT CONNECTOR



VIEW ON B
WRAP TAPE CLOCKWISE
TO ENSURE TORQUE IS
POSITIVE



TYPICAL VIEW OF 90 DEGREE CONNECTOR

C82656

Installation of Wiring Harness Electrical Insulating Tape (Post-SB24507 or Post-SB24372)
Figure 403

STANDARD PRACTICES - INSPECTION

1. General

A close and complete inspection is important to prolong engine life and give maximum performance. Check for loose or missing parts and inspect any engine part or component that has been worn or damaged. Damage to engine parts may result from improper clearance, lack of lubrication, undesired movement of parts which are bolted, pressed together, overloaded, uneven load distribution, heat, shock, extension of minor damage such as scratches, tool marks, grinding cracks, nicks, etc. Damage to engine parts may also result from presence of foreign matter such as grit, chips, moisture, chemicals, etc., or from incorrect techniques during removal and installation.

While it is frequently possible to repair a damaged part so that it may be safely reinstalled, it is important that the cause of the damage be determined and corrected if possible. Otherwise more serious consequences may result. Some of the physical conditions most commonly encountered during inspection of engine parts are listed in Table 601.

2. Inspection

A. Inspection Procedure

(1) Inspect parts for alignment, distortion, foreign matter, looseness, out-of-roundness, sharp edges, scratches, taper, warping and wear. Additionally, check the following:

(a) Holes in cases, manifolds, pipes and tubes for obstructions.

(b) Gear tooth and splines for contact patterns.

(c) Magnesium parts for corrosion.

(d) Mounting pads, parting and seating surfaces, for smoothness and flatness. Use pencil carbon paper whenever a smear-type indication of surface smoothness is required.

(e) Plugs for tightness.

(f) Studs, dowels, and similar protruding parts for alignment and projection length.

(g) Protective surface coatings for completeness.

(h) Threads for condition.

B. Inspection Gages

NOTE: When an inspection procedure requires a very accurate measurement, a micrometer, vernier caliper or a dial indicator must be used.

(1) If a micrometer or vernier is to be used, check gage for accuracy before making measurement. Ensure that contacting surfaces are clean and contacting faces of part to be measured are free of dirt and burrs. When using depth gages, ensure anvil is held tight and square against part to be measured.

(2) If a dial indicator is used, ensure indicator base is anchored firmly and that any swivel connections are tightened securely.

(3) When taking measurements with feeler gages, ensure final size of feeler is a reasonably snug fit.

C. Inspection of Fuel, Oil and Air Filters

(1) When determining the condition of engine fuel, oil lubrication and pneumatic systems, removed filters must be inspected for condition and contamination before the application of any allowable cleaning procedures. Clogged filters could be cause for downstream low pressure in systems.

NOTE: Other engine components will normally be cleaned prior to carrying out inspection procedure.

D. Inspection of Welded Repairs

(1) Inspect weld repair for quality, uniformity, undercutting, cracking and flux removal. Welds must be blended into adjacent metal in gradual, smooth curves. Welds must be sound, clean, free from foreign material, and from internal and external damage which would adversely affect strength of weld.

(2) Nominal welds (those not requiring finishing) must exhibit bead conditions as shown in Figure 601, detail A. Finished welds must exhibit bead conditions as shown in detail B.

E. Inspection of Fuel, Oil and Air Tubes

(1) Cracks - Cracked tubing must be replaced. No repair is permitted.

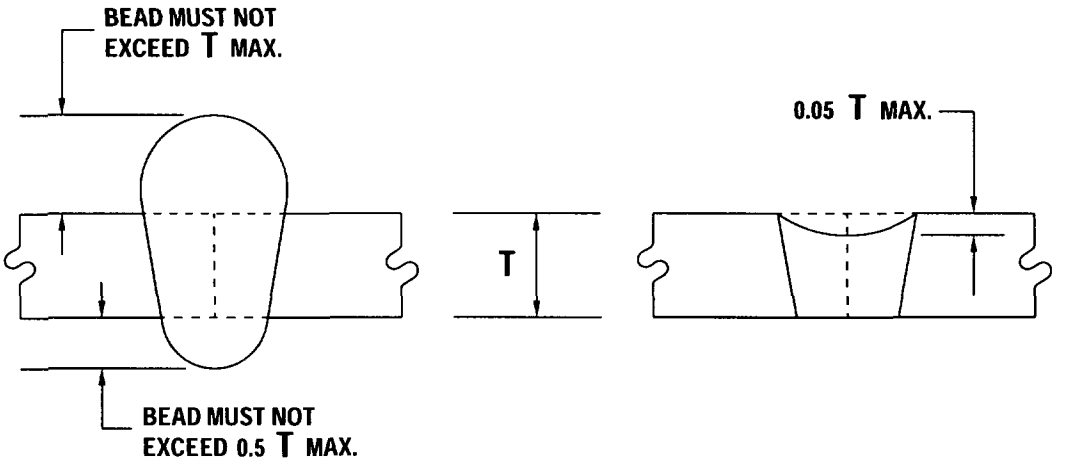
(2) Scratches - Minor scratches having no appreciable depth are acceptable. Scratches to a depth of 0.005 inch must be blended out. Replace tubing with scratches over 0.005 inch deep.

(3) Nicks - Individual nicks up to 0.062 inch long by 0.010 inch wide and 0.003 inch deep can be ignored. Nicks to a maximum depth of 0.005 inch must be blended out to remove sharp edges. Replace tubing with nicks greater than 0.005 inch deep.

(4) Dents - Round bottom dents on straight sections of tubing are permitted provided the length and depth are not greater than 10 percent of the normal outside diameter of tube. No more than one dent to maximum depth per 12 inch length of tube is acceptable. Dents on tube bends, which cause restriction by flattening and local weakening, are not acceptable.

(5) Pitting - Minor isolated pitting up to 0.003 inch deep is acceptable. Clusters of pitting should be blended out to a maximum depth of 0.005 inch. Tubing must be replaced if pitting exceeds 0.005 inch deep.

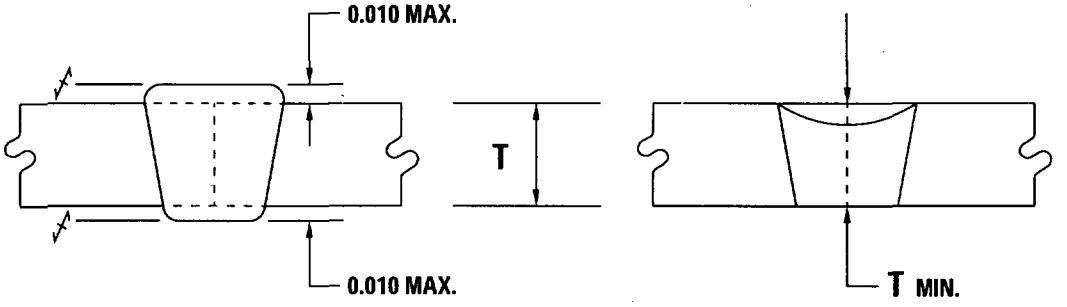
(6) Corrosion - Staining on tubing and surface corrosion is acceptable if removable by light polishing with crocus cloth and oil.



MAXIMUM MATERIAL CONDITION

MINIMUM MATERIAL CONDITION

A - NOMINAL WELD - NO FINISHING REQUIRED



MAXIMUM MATERIAL CONDITION

MINIMUM MATERIAL CONDITION

B - FINISHED WELD - DIMENSIONS AFTER DRESSING

C2589

Weld Repair - Inspection
Figure 601

TABLE 601, Typical Physical Conditions

TERM	DESCRIPTION	USUAL CAUSES
ABRASION	A roughened area. Varying degrees of abrasion can be described as light or heavy depending upon the extent of repair necessary to restore the surface.	Presence of fine foreign material between moving surfaces.
BEND	General distortion in structure as distinguished from a local change in conformation such as a dent, peening, etc.	Forces as defined under STRESS, or uneven application of heat.
BLISTERING	Raised areas indicating separation of the surface from the base. Usually found on plated or painted surfaces.	Imperfect bond with the base, usually aggravated by the presence of moisture.
BREAK	Complete separation by force into two or more pieces.	Fatigue; shock or overload.
BRINELLING	Indentations sometimes found on the surface of ball or roller bearing parts.	Improper assembly or disassembly e.g. removing or installing a roller or ball bearing by force on the free race.
BURNING	Injury to the surfaces by excessive heat. Evidenced by characteristic discoloration or, in severe cases, by loss or flow of material.	Excessive heat due to lack of lubrication, improper clearance.
BURNISHING	Mechanical smoothing of a metal surface by rubbing not accompanied by removal of material but sometimes by discoloration around the outer edges of the area.	Normal operation of parts.
BURR	A sharp projection or rough edge.	Faulty machining operations, excessive wear, peening.
CHAFING	A rubbing action between two parts having limited relative motion.	
CHIPPING	Breaking out of small pieces of material.	Concentration of stress due to shock, nicks, scratches, inclusions, peening, etc., careless handling of parts.
CORROSION	Breakdown of the surface by chemical action.	Presence of corrosive agents.

TABLE 601, Typical Physical Conditions (Cont'd)

TERM	DESCRIPTION	USUAL CAUSES
CRACK	A partial fracture.	Excessive stress due to shock overloading, extension of a nick or scratch, or overheating.
DENT	Small, smoothly rounded hollow in the surface.	Concentrated overload resulting from peening or the pressure of chips between loaded surface; striking of part with dull object.
ELECTROLYTIC ACTION	Breakdown of the surface by electrolytic action between parts composed of dissimilar metals.	Galvanic action between dissimilar metals.
EROSION	Carrying away of material by the flow of grit, chemicals, or hot gasses.	Flow of corroding liquids or grit-laden oils.
FATIGUE	Progressive yielding of one or more local areas of weakness such as tool marks, cracks, or inclusions, under repeated stress. The progressive nature of the failure is usually indicated by several lines approximately concentric about a center, or "focus" which discloses the original point of failure.	Tool marks, sharp corners, nicks, cracks, inclusions, galling, corrosion, insufficient tightening of studs or bolts to obtain proper stretch.
FLAKING	Breaking away of pieces of a plated or painted surface.	Incomplete bond; excessive load, blistering.
FRETTING CORROSION	Discoloration may occur on surfaces which are pressed or bolted together under high pressure. On steel parts the color is reddish brown. On aluminum the oxide is white.	Rubbing off in fine particles of metal slight movement between parts and subsequent oxidizing of these particles.
GALLING	The transfer of metal from one surface to another.	Severe chafing or fretting action caused during engine operation by a slight relative movement of two surfaces under high contact pressure.
GLAZING	Development of a hard, glossy surface on bearing surfaces.	Combination of pressure oil and heat.

TABLE 601, Typical Physical Conditions (Cont'd)

TERM	DESCRIPTION	USUAL CAUSES
GOUGING	Displacement of material from a surface by a cutting, tearing or displacement effect.	Presence of a comparatively large foreign body between moving parts.
GROOVING	Smooth rounded furrows, such as score marks where sharp edges have been polished off.	Concentrated wear, abnormal relative motion of parts; parts out of alignment.
GUTTERING	Deep, concentrated erosion.	Enlargement of a crack or damage by burning of an exhaust flame.
IMPERFECTION	An interruption (non-uniformity) in the normal surface condition of a part configuration which must be evaluated for acceptance to an assigned standard.	
INCLUSION	Foreign material enclosed in the metal. Surface inclusionsare indicated by dark spots or lines.	Inherent discontinuity in the material.
NICK	A sharp indentation caused by striking of one part against another metal object.	Carelessness in handling of parts or tools during, or prior to assembly; sand or fine foreign particles in the engine during operation.
PEENING	Deformation of the surface.	Impact of foreign object, such as occurs in repeated blows of a hammer on the part.
PICK-UP	Rolling up of metal, or transfer of metal from one surface to another.	Rubbing of two surfaces without sufficient lubrication; presence of grit between surfaces under pressure during assembly; unbroken edges of press fitted parts; incipient seizure of rotating parts during operations.
PILE-UP	Displacement of particles of a surface from one point to another.	

TABLE 601, Typical Physical Conditions (Cont'd)

TERM	DESCRIPTION	USUAL CAUSES
PITTING	Small, irregularly shaped cavities in a surface from which material has been removed by corrosion or chipping. Corrosive pitting is usually accompanied by a deposit formed by the action of a corrosive agent on the base material.	Corrosive pitting; breakdown of the surface by oxidation or some other chemical or electrolytic action.
PROFILE	The actual contour of a surface on a section perpendicular to that surface unless some other angle is specified.	
SCORING	Deep scratches made by sharp edges of foreign particles during engine operation; elongated gouges.	Presence of chips between loaded surfaces having a relative motion.
SCRATCHES	Narrow, shallow marks caused by the movement of a sharp object or particles across a surface.	Carelessness in handling of parts or tools prior to, or during, assembly; sand or fine foreign particles in engine during operation.
SMOOTH	A surface that is continuously even, free of irregularities, presenting no resistance to the sliding of a finger or spherical stylus. Can be applicable to a one plane surface or transition surfaces between planes.	
SPALLING	Sharply roughened area characteristic of the progressive chipping or peeling of surface material.	Surface crack, inclusion or similar surface injury causing a progressive breaking away of the surface under load.
STRESSES	When used in describing the cause of failure of machineparts, stresses are generally divided into three groups - compression, tension and shear. These are used to describe the forces as follows:	

TABLE 601, Typical Physical Conditions (Cont'd)

TERM	DESCRIPTION	USUAL CAUSES
	COMPRESSION - Action of two directly opposed forces which tend to squeeze a part together.	
	TENSION - Action of two directly opposed forces which tend to pull apart.	
	SHEAR - Action between two opposed parallel forces.	
SURFACE	The designed boundary, shape and extent of which is usually shown and dimensioned on an illustration	
TORSION	External twisting opposed by shear stress.	

F. Inspection of Rotating Components

WARNING: LIFE LIMITED (CRITICAL) ROTATING COMPONENTS EXHIBITING CRACKS ARE UNSERVICEABLE AND SHALL NOT BE REPAIRED.

CAUTION: HANDLE ROTATING COMPONENTS WITH EXTREME CARE TO PREVENT DAMAGE OR CONTAMINATION OF THE MATERIAL.

CAUTION: WEAR LINT FREE GLOVES WHEN TOUCHING ROTATING COMPONENTS.

CAUTION: MAKE SURE CLOSE ATTENTION IS PAID TO AREAS SUCH AS COUNTERWEIGHT HOLES AND BLADE SLOTS WHERE IMPERFECTIONS ARE DIFFICULT TO FIND.

CAUTION: USE SUITABLE CLEAN, PROTECTIVE CONTAINERS FOR STORING AND TRANSPORTING COMPONENTS.

(1) Inspect components in accordance with the criteria specified in the relevant Chapter/Section/Subject.

(2) Any observed conditions not defined in this manual are not acceptable for repair.

(3) Evaluation of the surface should take into consideration the need for repairs and the limits to which repairs may be made to determine the suitability for continued use of the component.

(4) Unrepairable components shall be quarantined to prevent further use.

(5) It is important to have suitable lighting. The minimum recommended illumination for close and difficult inspection is 100 foot-candles measured at the inspection table top.

(6) Unless otherwise specified, magnification shall not be used. A magnification of 3 to 4X may be used as an aid to evaluate and confirm an observed condition in detail.

STANDARD PRACTICES - CLEANING

1. General

   A. Gas turbine cleaning can be put into two groups; specific parts cleaning and field cleaning (i.e., compressor washing).

   B. Specific parts cleaning is primarily to remove contaminants which might conceal minor cracks and other damages which, if not detected, could eventually lead to failure of a component or part.

   C. Engine components or parts should be cleaned only as necessary to do the required inspection and repair. Over-cleaning of components or parts is unnecessary and should be avoided. The cleaning methods given in the following text are sufficient for all maintenance levels.

   D. Refer to Chapter 71-00-00 for compressor washing methods.

2. Consumable Materials

   The consumable materials listed below are identified in procedural text.

Item No.	Name
PWC05-256	Enhancer, Contact
PWC11-014	Alcohol, Isopropyl
PWC11-027	Solvent, Petroleum
PWC11-036	Solvent, Deoxidizer
PWC11-041	Cleaner, Degreaser

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Cleaning

   A. General Precautions

      (1) Make sure that the work area is clean, prior to engine disassembly.

      (2) Benches on which engine parts are placed must be clean and free from grit, metal filings, etc., which may contaminate engine oil systems, fuel systems or hardware.

      (3) Clean plastic bags should be available in which oil system and fuel system parts may be stored until ready for re-assembly.

      (4) Clean plastic caps or covers should be used to protect exposed tubes or bearing areas.

(5) At re-assembly, make sure that all parts are clean and new preformed packings are installed.

B. Cleaning Precautions

NOTE: The choice of cleaning agents should be limited to consumables listed in INTRODUCTION. The toxicity of cleansing agent will depend on the type of contamination encountered on part to be cleaned.

CAUTION: TAKE PARTICULAR CARE IN SELECTING CLEANING METHOD TO MAKE URE THAT ANODIZING AND OTHER PROTECTIVE COATINGS ARE NOT REMOVED FROM PARENT METAL.

CAUTION: DO NOT USE ALKALIS ON ALUMINUM, MAGNESIUM, ALUMINIZED AND PAINTED AREAS.

(1) Wear rubber gloves, apron or coveralls and face shield or goggles, when working with solvents.

(2) Use the least toxic of available cleaning materials which will satisfactorily do the work.

(3) Do all cleaning operations in a well ventilated work area.

(4) Make sure that correct and usable fire fighting and safety equipment is conveniently located and available to all personnel.

(5) Do not smoke or expose a flame within 50 feet of cleaning area.

(6) Make sure that all de-greasing agents are fully removed from all parts after cleaning.

(7) Do not use steel brushes for any cleaning operation except when specified within this manual. Use a stiff bristle fiber brush.

C. Cleaning Before Welding

(1) Surface to be welded must be free from protective coatings, dirt, grease, oil and other contaminants, and as free as possible from oxide formation.

(2) Wire brushes and abrasives may be used to remove protective coatings and oxides, except that the final step in removing oxides from aluminum alloys should consist of chemical treatment immediately prior to welding.

(3) Wire brushes, when used for cleaning corrosion-resistant alloy, must have bristles of austenitic, corrosion-resistant steel.

(4) No undesirable deposit or residue must remain on surface to be welded after cleaning operation.

D. Cleaning After Blending or Polishing

(1) Use suction air to remove metal particles on repaired components.

(2) Use a clean soft cloth, dampened with petroleum solvent (PWC11-027) or equivalent to remove polishing compound residue and other foreign material particles.

6. Wiring Harness Connectors

A. Cleaning

WARNING: USE SPRAY PRODUCTS IN A WELL VENTILATED AREA. AVOID INHALATION OF SPRAY.

WARNING: USE APPROVED PERSONAL PROTECTIVE EQUIPMENT TO PROTECT EYES AND FACE WHEN USING COMPRESSED AIR. DO NOT DIRECT AIRSTREAM TOWARDS YOURSELF OR TOWARDS ANOTHER PERSON.

(1) Spray electrical contact pins and connector shell with isopropyl alcohol (PWC11-014) and blow out any resulting debris with clean, oil free, compressed air at 30 psig (207 Kpa) maximum.

B. Application of Electrical Contact Enhancer

NOTE: 1. It is not recommended to use contact enhancer on PMA connectors J11 and J12, pins A, B and C, because of the high amperage generated by the PMA.

NOTE: 2. It is not recommended to use contact enhancer on wiring harness connectors P1 and P4, Pre-SB24434/Post-SB24514 pins NN, HH and w, or Post-SB24434/Pre-SB24514 pins T, U and r, because of the high amperage generated by the PMA.

(1) Use a spray or brush to apply cleaner (PWC11-041) or isopropyl alcohol (PWC11-014) to the electrical contacts.

(2) Use a spray or brush to apply solvent (PWC11-036) to the electrical contacts.

(3) Connect and disconnect the plug and socket two or three times to clean the contacts.

(4) Flush the contacts with solvent (PWC11-027) or cleaner (PWC11-041).

WARNING: WEAR GOGGLES OR A FACE SHIELD TO PROTECT YOUR EYES. CONTROL THE AIR PRESSURE TO 29 psig (200 kPa) MAXIMUM.

(5) Dry the connectors with dry, filtered compressed air.

(6) Prepare diluted electrical contact enhancer as follows:

(a) Mix 1 ml. of alcohol (PWC11-014) thoroughly with 15 ml. of electrical contact enhancer (PWC05-256).

(7) Put a drop of diluted electrical contact enhancer (PWC05-256) on each connector pin.

NOTE: Let the fluid flow downward on each pin to make a thin film.

STANDARD PRACTICES - REPAIR

1. General

   A. The primary purpose of repair is to enable a component or engine part to be reworked to a condition which will provide safe operation. Approved repair schemes are detailed in the relevant sections of this manual using the various consumables listed in CONSUMABLE MATERIALS.

2. Consumable Materials

   The consumable materials listed below are identified in procedural text.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-055	Sodium Dichromate, Heat-Shrinkable
PWC05-057	Solution, Sodium Hydroxide
PWC05-061	Cloth, Coated Abrasive
PWC05-073	Water, Distilled Deionized or Demineralized
PWC05-147	Electrode, 2% Thoriated
PWC05-161	Solution, Touch-Up Chrome Pickle
PWC05-162	Wetting Agent, Chromate
PWC05-170	Compound, Polishing
PWC05-195	Acid, Nitric
PWC05-196	Acid, Hydrochloric
PWC05-197	Acid, Chromic
PWC05-198	Salts, Chromate Conversion
PWC05-272	Compound, Polishing
PWC09-002	Compound, Locking and Retaining
PWC11-016	Perchlorethylene, (Inhibited)
PWC11-019	Solution, Chromate Conversion
PWC11-027	Solvent, Petroleum

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC31771	Spreader

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Welding Repairs

A. General

(1) A tungsten inert gas fusion welding process must be used when repairing cracks in engine parts. Argon or helium gas maybe used in inert gas welding; however, argon is preferred by Pratt & Whitney Canada because its greater density reduces its rate of diffusion with the atmosphere.

(2) Inert gas welding is a gas arc welding process which uses inert gas to protect the weld area from the surrounding atmosphere. The heat necessary for welding is provided by a very intense electric arc which is struck between a non-consumable thoriated tungsten (PWC05-147) (tungsten and thorium alloy) electrode and the metal part. On repairs where a filler material is required, a welding rod, of appropriate material, is fed into the weld area and melted with the base metal in the same manner as in conventional gas welding.

B. Welding Equipment

(1) The following equipment is required for the inert gas welding process:

(a) An AC/DC arc welder with high frequency controls

(b) A Linde HW-10 torch, or equivalent, with circulating water equipment, and ceramic cups of suitable size.

WARNING: IF AN OXYGEN REGULATOR IS USED WITH ARGON GAS, DO NOT REINSTALL REGULATOR ON AN OXYGEN CYLINDER. ARGON GAS IS NOT FREE FROM OIL AND THE POSSIBILITY EXISTS OF AN EXPLOSION CAUSED BY PRESENCE OF OIL IN THE REGULATOR.

(c) An argon gas regulator.

(d) Two flowmeters.

C. Cleaning Before Welding

(1) Refer to Standard Practices - Cleaning.

D. Welding Procedures

(1) Welding must be carried out only by certified personnel.

(a) Connect one argon gas flowmeter to torch and connect other flowmeter, if necessary, behind crack as a backup when ready to weld.

(b) Connect torch to arc welder for straight polarity.

(c) Insert a 1/16 inch diameter thoriated tungsten electrode (PWC05-147) into torch, allowing approximately 5/16 inch of electrode to protrude from ceramic cup. The ceramic cup used must not be smaller than a No. 6 for the HW-10 torch, in order to provide a sufficient amount of inert gas to the weld area where cleanliness of the surface beader is important.

NOTE: A plain tungsten electrode may be used, but a needle point must be maintained on the electrode for more positive starting of arc. Where possible, the electrode must be kept clean of material pickup.

(d) If it is necessary to protect underside of weld from contamination, possible weld porosity, or poor surface finish, attach argon gas line behind crack to be welded. This may be accomplished by fabrication of small box-like fixtures having edges shaped to fit contours of part to be welded and using a suitable connection to secure gas line. Seal fixture to part in order to conserve gas leakage to minimum.

NOTE: The amount of gas pressure to provide sufficient backup must be determined. This pressure should not allow the gas to stir the weld puddle. Do not use flux when welding in an inert atmosphere.

(e) When high frequency controls are used, it is not necessary to strike an arc. Hold torch vertically to work so that the shielding gas (argon) forms a protective envelope around the weld. It is preferable to have area to be welded in a horizontal position.

(f) When high frequency controls are not used, strike arc and hold electrode tip approximately 1/8 to 1/4 inch above surface to be welded until a puddle is formed. Add welding rod, as applicable, and proceed as in conventional gas welding.

NOTE: Test welds, using corresponding material of same thickness and joint design, should be made to determine correct gas pressure and arc welding settings.

(g) Because a high percentage of steel parts used in the engine are fabricated from 12 percent chromium corrosion-resistant steels, which are characterized by their susceptibility to air hardening, field repair of cracks by fusion welding is a special problem. The high temperature at which fusion weld repairs are made and the subsequent air cooling of the part, or parts, from these temperatures usually results in an increase in material hardness and a loss in ductility. Parts on which fusion weld repairs have been made have a tendency to crack because the steel structure becomes unstable, brittle and highly stressed. The structure of the material can be improved by reheating the parts and controlling the cooling rate.

E. Cleaning After Welding

Refer to Standard Practices - Cleaning.

F. Local Stress Relief

Components which are not highly stressed may be repaired by fusion welding. If is possible to partially restore the original properties of such welded parts through use of local heat treatment. The localized heat may be applied by neutral flame of an oxyacetylene torch. Extend the stress relief one inch minimum beyond the welded area. After the desired heat has been applied to the part for the correct length of time, reduce temperature of part gradually.

G. Inspection of Welding

Refer to Standard Practices - Inspection.

H. Blend Repair Procedure

(1) Blend repair using carborundum stones.

(2) Polish blended area using crocus cloth (PWC05-061).

CAUTION: DO NOT POLISH WITH POWER TOOLS.

(3) Blend all repairs and finish smoothly.

(4) Lines, scratches, or sharp edges which may cause a concentration of stress are not permitted.

6. Helical Coils

A. Replacement of Helical Coil Inserts

CAUTION: BEFORE USING HELICAL COIL INSERTS, IN ANY PART OF ENGINE, REFER TO ILLUSTRATED PARTS CATALOG, P&WC MANUAL P/N 30B1403, APPROVED LOCATIONS AND PARTICULAR PART NUMBER OF INSERT.

(1) Remove unserviceable insert using an approved extraction tool.

(2) Clean out hole and ensure swarf and other foreign matter is removed.

(3) Using new helical coil insert, install insert into threaded hole using insert installation tool. Insert outer thread must be between one and one-half threads below surface of hole or counterbore, whichever applies.

(4) Cut off driving tang at notch using approved tang removal tool and remove tang from holes.

(5) Inspect repaired hole.

7. Studs

A. Replacement of Studs

(1) General

(a) When necessary, oversize studs are to be installed in place of those which are broken, stretched, loose or have damaged external threads. Whenever a stud which is already oversize requires replacement, install the next oversize stud. Use correct stud drivers to install new studs and torque to appropriate value (Ref. Tables 801 or 802, as applicable).

TABLE 801, Standard Stud Torque Limits

Stud Thread Size (Drive End)	Minimum	Maximum Necked Down $	Maximum Plain #
0.112-40	4	-	8
0.138-32	8	-	14
0.164-32	10	30	30
0.190-24	15	40	45
0.216-24	20	65	70
0.250-20	40	95	105
0.3125-18	85	210	230
0.375-16	160	375	425
0.4375-14	200	600	675
0.500-13	250	950	1050

NOTE: 1. Symbol $: These limits apply where the unthreaded diameter of the stud is less than the minimum minor diameter of the coarse pitch thread (drive end).

NOTE: 2. Symbol #: These limits apply where the unthreaded diameter of the stud is equal to or greater than the minimum minor diameter of the coarse pitch thread (drive end).

TABLE 802, Stepped Stud Torque Limits

Stud Thread Size (Nut End)	Minimum	Maximum Necked Down $	Maximum Plain #
0.138-40	8	-	18
0.164-36	10	30	30
0.190-32	15	45	50
0.216-28	20	65	75
0.250-28	40	115	125
0.3125-24	85	240	260

TABLE 802, Stepped Stud Torque Limits (Cont'd)

Stud Thread Size (Nut End)	Minimum	Maximum Necked Down $	Maximum Plain #
0.375-24	160	450	500
0.4375-20	200	700	800
0.500-20	250	1150	1300

NOTE: 1. Symbol $: These limits apply where the unthreaded diameter of the stud is less than the minimum minor diameter of the fine pitch thread (nut end).

NOTE: 2. Symbol #: These limits apply where the unthreaded diameter of the stud is equal to or greater than the minimum minor diameter of the fine pitch thread (nut end).

CAUTION: BEFORE INSTALLING NEW STUDS, REFER TO ILLUSTRATED PARTS CATALOG, P&WC P/N 30B1403, FOR APPROVED LOCATIONS AND PART NUMBERS.

(b) When threads of a stud hole are damaged beyond dimensions suitable for fitting a maximum oversize stud, it is usually possible to effect repairs by the installation of a helical coil (Ref. Para. A.) or key-type insert. Consideration should, however, be given to reduction of thickness of walls or parent metal around insert and the required strength. Specific problems should be referred to P&WC Service Department (Ref. INTRODUCTION).

(2) Replacement of a Damaged Stud

(a) Remove damaged stud using an approved method.

(b) Examine stud hole for condition; on worn stud holes use oversize studs.

(c) Install stud using an approved stud driver to correct protrusion height; ensure torque limits (Ref. Tables 801 or 802, as applicable) are not exceeded.

B. Repair of Damaged Stud Hole

(1) Ensure damaged hole is suitable for repair in accordance with Subpara. A. preceding.

(2) Measure core depth of existing hole.

(3) Select relevant size drill and drill hole to depth measured in step (2), preceding.

(4) Using relevant special tap, thread hole one thread deeper then insert to be fitted.

(5) Where applicable, counterbore hole to required angle and depth.

(6) Clean out hole and ensure freedom from metal chippings and other foreign matter.

(7) If part being repaired is magnesium, treat tapped hole with chrome pickle touch-up solution (PWC05-161) as follows:

(a) Clean area to be treated with crocus cloth (PWC05-061) and/or cloth impregnated with perchlorethylene (PWC11-016).

(b) On rough surfaces, remove corrosion using wire brush or abrasive paper.

(c) On finished surfaces, remove corrosion using swab or brush impregnated with hot chromic acid solution (PWC05-197) at 85° to 93°C (180° to 200°F).

(d) Rinse with clean cold water.

(e) Rinse with clean hot water.

(f) Dry using clean, dry compressed air.

(g) Apply chromic acid solution to area to be treated using a clean cloth. Repeat swabbing at frequent intervals to ensure treated area is maintained wet with solution during treatment.

(h) Thoroughly rinse touched up area by swabbing several times with clean cloth moistened with water.

(i) Dry using clean, dry compressed air.

(8) Using appropriate size helical coil insert, install insert into repaired stud hole (Ref. Para. A.).

8. Shanknuts

A. Replacement

(1) Equipment RequiredShanknut Spreader (PWC31771)

(2) Procedure (Ref. Fig. 801)

CAUTION: AVOID DAMAGE TO FLANGE.

(a) Using a suitable drill, partially remove the flared end of shanknut.

(b) Remove shanknut using a parallel pin punch at drilled end to shear weakened flare, and retrieve the case.

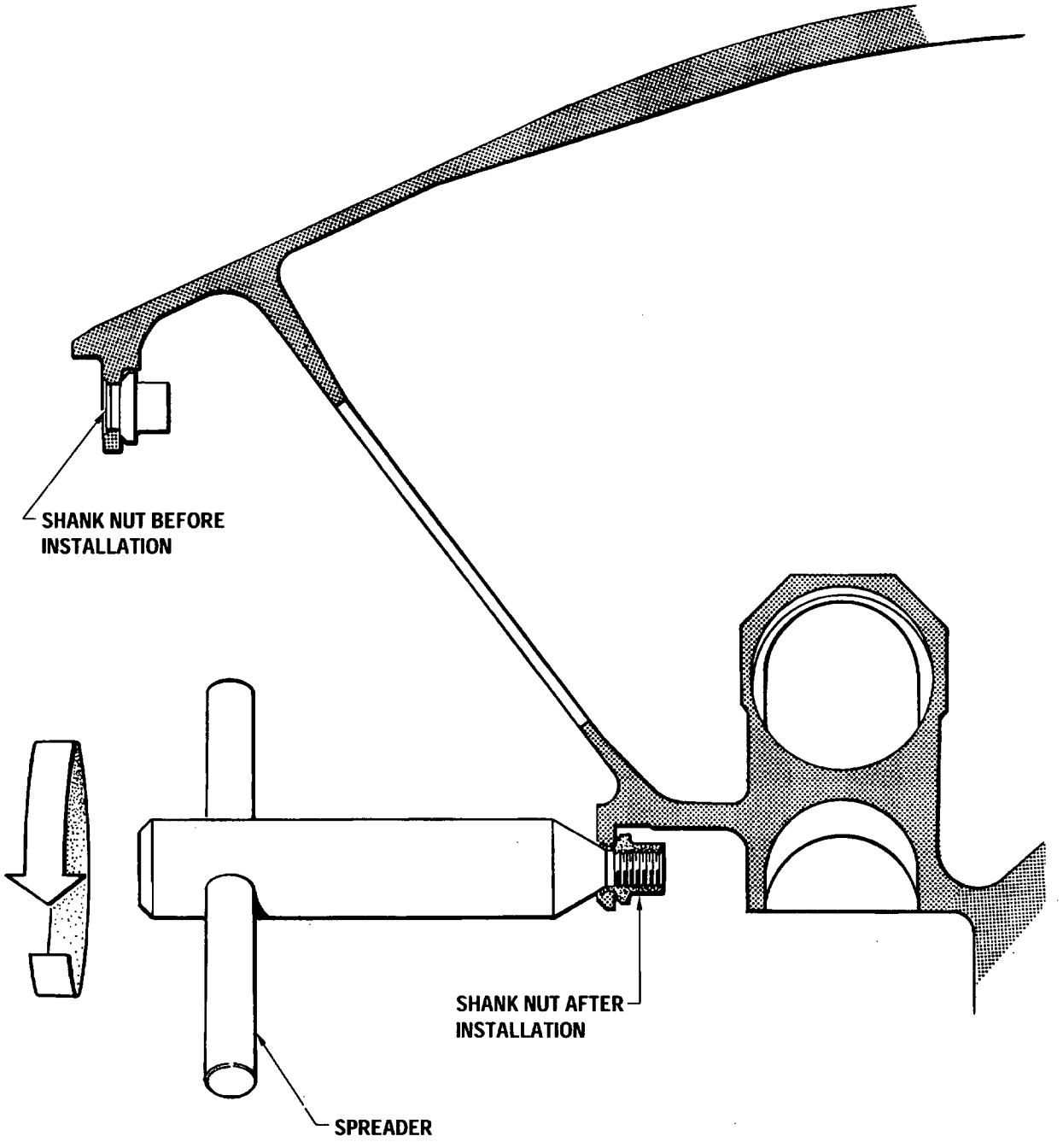
(c) Install new shanknut and hold against flange.

(d) Lightly lubricate tapered portion of shanknut spreader (PWC31771) with engine oil (PWC03-001) and screw into shanknut until shank end is flared against flange.

(e) Remove shanknut spreader and examine flared end of shanknut for correct forming with no evidence of deformation or cracks.

9. Electrical Connectors

Refer to Cleaning.



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Shanknut Replacement
Figure 801

10. Blend Repair of Rotating Components

A. General

(1) Definitions:

BLENDING	An operation that removes an irregularity or imperfection from a surface and results in restoring the surface to a smooth acceptable condition.
GRINDING	An operation that removes material by the use of an abrasive material to produce a predetermined size.
POLISHING	A finishing operation which produces a smooth surface finish.

(2) Repairs are defined as freehand blending, deburring and/or polishing. It does not include machining or machine grinding.

(3) Perform repairs only on defined damage within the limits specified in the relevant Chapter/Section/Subject. Undefined damage shall render the component unserviceable.

(4) Perform repairs in a direction so that the finishing marks follow the lay of the original manufacturing machining marks.

(5) Restore surface finish of repaired area to the original manufacturing finish.

(6) Make sure repaired area conforms to the original manufacturing shapes, profiles, contours and radii.

(7) Make sure local repairs extend over an area 10 times the depth of damage.

(8) Maintain a smooth transition between repaired areas and adjacent areas.

(9) Make sure repaired area depth is 1/3 deeper than the depth of damage to ensure removal of damage.

(10) Perform visual inspection of all blend repaired components.

B. Blend Repair Procedure

(1) Blending:

CAUTION: USE EXTREME CARE TO AVOID OVERHEATING COMPONENTS DURING REPAIR.

(a) Remove minor damage, less than 0.003 inch deep by blending using hand tools such as suitable files, abrasive paper or cloth and/or stones of appropriate shape, dimensions and grit size.

(b) Remove more significant damage by blending using rotary files, abrasive disks and/or wheels of appropriate shape, dimensions and grain size mounted on a hand held air gun. Maintain low spindle speed and minimum wheel pressure.

(c) Use silicon carbide abrasives for blending the surface of titanium base components to remove traces of imperfections.

(d) Use silicon carbide or aluminum oxide abrasives for edge breaking, hole deburring and radius restoration of titanium base components.

(e) Use aluminum oxide abrasives for blending the surface of nickel base components to remove traces of imperfections, edge breaking, hole deburring and radius restoration.

(2) Polishing:

(a) Polish reworked areas to restore original manufacturing surface finish using abrasive cloth or paper of grit size no. 240 or finer.

(b) Polish wheel marks and light damage using a suitable cloth wheel with polishing compound (PWC05-272) for titanium base components and (PWC05-170) for steel and nickel base components.

(c) Always use silicon carbide abrasives for polishing the surface of titanium base components.

(d) Use aluminum oxide abrasive for polishing the surface of nickel base components.

(e) Coarse abrasives of grit size no. 120 may be used to remove deep imperfections on the components.

(f) Polish surface using progressively finer abrasives until the correct surface finish is achieved.

(g) Remove each tool or grinding line before using the next finer abrasive.

(3) Buffing:

(a) Buff reworked areas using a buffing wheel and polishing compound (PWC05-272).

(4) Hand Blending Air Gun:

(a) The air gun is hand held, with an adjustable spindle speed and drives a suitable mandrel.

(b) Use a piece of aluminum oxide or silicon carbide abrasive cloth, rotary file or abrasive disk or wheel of appropriate shape, dimensions and grit size for hand grinding rotating components.

(c) Adjust the rotation of the hand blending wheel to obtain the required surface finish.

(d) Do not allow the rotation of the wheel to exceed 2000 RPM.

(e) Avoid excessive rotation to prevent local overheating of the material.

(f) Adjust the applied presssure of the hand blending wheel to produce a maximum of 0.0005 inch of material removal in each pass.

(g) Make sure the applied presssure is light and equal to prevent local overheating.

(h) A light, equal pressure on the hand blending wheel gives the best results as it permits the abrasive to cut easily without loading up.

(i) Heavy or extreme pressure on the hand blending wheel will cause it to load up and result in burning of the material.

11. Anchor Nuts

A. Replacement

(1) Use an applicable drill to drill the crimped rivet head on the self-locking-nut side of the bracket.

(2) Use a parallel pin punch to remove the rivet. Remove the self-locking nut plate.

(3) Remove the raised and unwanted material from the holes.

(4) Install a new self-locking nut plate on the bracket. Install rivets. The manufactured head of the rivets must be on the side opposite to the nut on the bracket.

(5) Use a riveter to crimp the rivets.

12. Jacking Insert

A. Replacement

(1) Remove jacking insert, with a suitable size drill.

(2) Remove locking compound residue and clean insert seat and associated area, with a wire brush and solvent (PWC11-027).

(3) Coat insert (Ref. IPC) with locking compound (PWC09-002) and install in flange.

(4) To cure compound, locally heat insert to 207 to 217°F (97 to 103°C), with a heat gun for 10 to 15 minutes.

13. Chromate Repair of Magnesium Casings (AGB and Intermediate Case)

A. Preparation of Chromate Conversion Solution (PWC11-019) (Ref. Table 803)

WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIALS INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

(1) Fill suitable container to 3/4 level with tap water.

(2) Slowly and carefully add required amount of conversion salts (PWC05-198).

(3) Slowly and carefully add required amount of hydrochloric acid (PWC05-196) and stir to mix.

(4) Slowly and carefully add required amount of wetting agent (PWC05-162) and stir to mix.

(5) Fill container to operating level and stir to mix.

(6) Add hydrochloric acid (PWC05-196) or a combination of sodium hydroxide (PWC05-057) and 16 oz of water (PWC05-073) to adjust pH, as necessary. Stir to mix.

TABLE 803, Chromate Conversion Solution (PWC11-019)

Material	Make-up	Operating Limits
Chromate Conversion Salts - magnesium (PWC05-198)	5 oz. wt/gal	4.5 - 5.5 oz. wt/gal
Hydrochloric Acid (PWC05-196)	2 fl oz/gal	1 - 3 fl oz/gal
Wetting agent (PWC05-162)	1 ml/gal	
Sodium Hydroxide Solution (PWC05-057 and 16 oz water PWC05-073)	Add, as necessary, to raise pH to operating range.	pH = 0.6 - 1.1
NOTE: To maintain (PWC05-162), add 0.5 ml for every 5 oz (PWC05-198) added.		

B. Preparation of Chrome Pickle Solution (PWC05-161) (Ref. Table 804)

WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIALS INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

(1) Fill container 1/2 full with tap water.

(2) Add sodium dichromate (PWC05-055) slowly and carefully to the water. Stir to dissolve.

(3) Add nitric acid (PWC05-195) slowly and carefully . Stir to mix.

(4) Fill remainder of the container with tap water. Stir to mix.

TABLE 804, Chrome Pickle Solution (PWC05-161)

Material	Make-up	Operating Limits
Sodium Dichromate (PWC05-055)	1.5 lbs	1.0 - 1.5 lbs
Nitric Acid (PWC05-195)	1.4 pints	1.0 - 1.5 pints
NOTE: Figures given are weights per gallon of solution.		

C. Procedure

(1) Clean surface to be repaired using a swab soaked in perchlorethylene (PWC11-016) and/or crocus cloth (PWC05-061).

(2) Remove corrosion with a swab or brush, soaked in a hot 82 to 163°C (180-325°F) chromic acid solution (PWC05-197).

(3) Rinse with clean water at room temperature.

(4) Rinse with clean water heated to 60°C (140°F) minimum).

(5) Dry with clean low pressure compressed air at 200 kPa (29 psig).

(6) Apply chromate solution (PWC11-019) or chrome pickle solution (PWC05-161) at a temperature of 17 to 29°C (55-85°F) for 30 to 45 seconds to prepared surface, with a swab or brush. Repeat application frequently to make sure surface is continually wet with solution during the treatment.

(7) Swab area with clean water until successive swabs are no longer stained yellow.

(8) Dry part in oven or with local heating for 20 to 30 minutes at 85 to 177°C (185-350°F).

D. Restoration of Protective Coating on Painted Surfaces

NOTE: The following steps do not apply to flanges, engine mount pads or accessories mount pads. For repair of corrosion on engine mount pads Refer to 72-30-01 Assembly.

(1) Treat exposed metal, refer to Para. 13. Sub-para. A., B. and C..

(2) Mask area not to be painted.

(3) Apply two coats of epoxy primer (PWC13-001). Wait one hour between the two coats. Allow to air dry at room temperature for eight hours minimum after the second coat.

(4) Apply three coats of aluminized epoxy enamel (PWC05-037). Wait 15 to 30 minutes between each coat. Allow the final coat to air dry at room temperature for 24 hours minimum.

(5) Remove masking and check for full coverage of the exposed area.

CHAPTER 71 POWERPLANT

TABLE OF CONTENTS

SUBJECT	PAGE
POWER PLANT - ADJUSTMENT/TEST	**71-00-00**
1. General	501
2. Consumable Materials	501
3. Special Tools	501
4. Fixtures, Equipment and Supplier Tools	502
5. Ground Safety Precautions	502
A. General	502
B. Air Intake - Engine Running	504
C. Exhaust Jet Wake Area - Engine Running	504
D. Cool Down	504
E. Jet Fuel and Lubricating Oil	504
6. Test Information	504
A. Symbols	504
B. Instrument Accuracy	505
C. Engine Operating Limits	505
D. Data Plate Information	505
E. Engine Overtemperature	507
F. Engine Overspeed	507
G. Foreign Object Damage	507
H. Fuel	507
I. Precipitation	507
7. Extreme Weather Information	508
A. Cold Weather Procedure	508
B. Hot Weather Procedures	508
8. Engine Ground Checks	508
A. Major Component Repair/Replacement Cross Reference	508

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
POWER PLANT - ADJUSTMENT/TEST (Cont'd)	**71-00-00**
B. Check No. 1 - Prestart	509
C. Check No. 2 - Engine Start	510
D. Check No. 3 - Engine Shutdown	511
E. Check No. 4 - Power Assurance	511
F. Sample Performance Calculation	518
G. Check No. 5 - Emergency Fuel Shut-off Cable Rigging	518
H. Check No. 6 - Bleed Valve Operation	518
I. Check No. 7 - T4.5 Increase of 20°C or More	523
9. Motoring Runs	524
A. Dry Motoring Run (PW305A)	524
B. Dry Motoring Run (PW305B)	525
C. Wet Motoring Run (PW305A)	525
D. Wet Motoring Run (PW305B)	526
E. Emergency - Ground Fire	526
10. Adjustments	527
A. Engine Oil Pressure Adjustment (Pre-SB24367/Pre-SB24395)	527
B. Engine Oil Pressure Adjustment (Post-SB24367/Post-SB24395)	527
C. IGV Actuator Rigging	527
11. In-situ Fan Trim Balancing - ACES Model 1700 Analyzer	529
A. General	529
B. Installation of Vibration Sensor	529
C. Installation of Optical Tachometer Probe	531
D. Installation of N2 Extension Cable	531
E. Hook-up Speed Unit to Aces Analyzer	531
F. Installation of Reflective Tape on Inlet Cone	533

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
POWER PLANT - ADJUSTMENT/TEST (Cont'd)	**71-00-00**
G. Vibration Survey	533
H. Initial Fan Balance Run	535
I. Trial Weight Trim Balance Run	537
12. In-situ Fan Trim Balancing - TEC Model 4040 Viper Analyzer	541
A. General	541
B. Installation of Vibration Analysis Equipment	541
C. Vibration Survey	543
D. Initial Fan Balance Run	559
E. Trial Weight Trim Balance Run	561
13. Rivet and Counterweight - Front Hub	562
A. Removal of Rivet and Counterweight	562
B. Installation of Rivet and Counterweight	565
POWER PLANT - CLEANING	**71-00-00**
1. General	701
2. Consumable Materials	701
3. Special Tools	701
4. Fixtures, Equipment and Supplier Tools	701
5. Engine External Wash	702
A. Procedure	702
6. Internal Washing	702
A. General	702
B. Preparation of Equipment	704
C. Preparation of Cleaning Solutions	705
D. Engine Preparation	710
E. Fan Washing	710

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
POWER PLANT - CLEANING (Cont'd)	**71-00-00**
F. Compressor Washing (Desalination or Performance Recovery)	711
G. Post Compressor Washing	713
H. Turbine Washing	713

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Nov 28/2008
	2	Nov 28/2008
Contents	1	Nov 28/2008
	2	Nov 28/2008
	3	Nov 28/2008
	4	Nov 28/2008
71-00-00 Adjustment/ Test	501	Nov 28/2008
	502	Nov 28/2008
	503	Nov 28/2008
	504	Nov 28/2008
	505	Nov 28/2008
	506	Nov 28/2008
	507	Nov 28/2008
	508	Nov 28/2008
	509	Nov 28/2008
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	564	Nov 28/2008
	565	Nov 28/2008
	566 blank	Nov 28/2008
71-00-00 Cleaning/ Painting	701	Feb 15/2008
	702	Feb 15/2008
	703	Feb 15/2008
	704	Feb 15/2008
	705	Feb 15/2008
	706	Feb 15/2008
	707	Feb 15/2008

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
	708	Feb 15/2008
	709	Feb 15/2008
	710	Feb 15/2008
	711	Feb 15/2008
	712	Feb 15/2008
	713	Feb 15/2008
	714	Feb 15/2008

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POWER PLANT - ADJUSTMENT/TEST

1. General

   A. This section contains information for ground running PW305 series engines. Checks and adjustment procedures are outlined in Table 501 and verify the integrity of installed/replaced items. Refer to Chapter 5-10-00 for overtemperature and overspeed limits.

   B. The operating procedures contained in this section are based on Pratt & Whitney Canada supplied items; no attempt has been made to cover airframe supplied items for the many possible variations in installation. Since the performance curves are based on the uninstalled engine, refer to the power plant section of the applicable Aircraft Maintenance Manual (AMM) for current performance data.

   C. The Advanced Computer Engine Surveys (ACES) special equipment listed below, used for fan trim balancing, is available from:

      Technology Energy Corp.
      10737 Lexington Drive, P.O. Box 22996
      Knoxville, TN 37932
      USA

      TEL: 865-671-2003
      FAX: 865-675-1241

      Website: www.acessystems.com

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC05-018	Pencil, Metal Marking
PWC05-238	Reflective Tape
PWC11-002	Solvent
PWC11-014	Alcohol, Isopropyl

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC43172	Puller
PWC43238	Riveter
PWC43239	Rivet Set
PWC43240	Rivet Set
PWC43430	Blanking Cover
PWC43435	Blanking Cover

Tool No.	Name
PWC43442	Velocity Sensor Bracket
PWC60085	Rivet Set
PWC60614	Punch
PWC62002	Fan Hub Protector
PWC62003	Riveter
PWC62004	Pusher
PWC62005	Protector
PWC62019	Split Retaining Ring
PWC66581	Fan Wedge
PWC66645	Chisel

4. Fixtures, Equipment and Supplier Tools

The fixtures, equipment and supplier tools listed below are used in the following procedures.

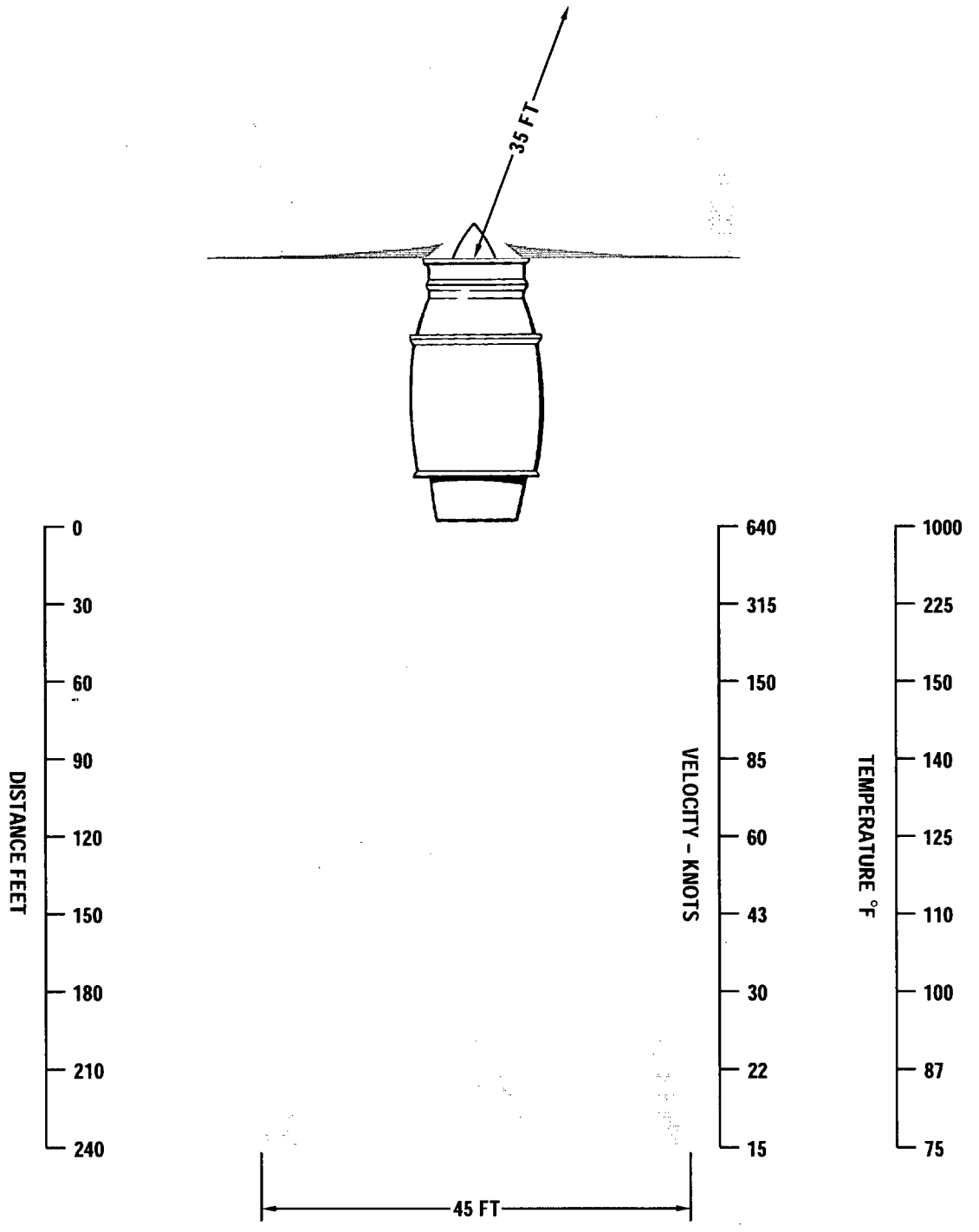
Name

Vibration Analyzer - Model 1700 - P/N 10-100-0464
Vibration Analyzer - Model 4040 Viper - 10-100-4040 (Alternate)
Vibration Sensor Cable - P/N 10-320-0131
Vibration Sensor Cable - P/N 10-320-0431 (Alternate)
Speed Unit - P/N 10-100-0485
Converter Box - P/N 10-100-0574
Optical Probe - P/N 10-100-1773
or 10-100-1300
High Temp. Cable - P/N 10-320-0008
Tacho Probe Cable - P/N 10-320-0126
Breakout Splitter - P/N 10-320-0167
N2 Extension Cable - P/N 10-320-0171
N2 Breakout Extension Cable - P/N 10-320-0471 (Alternate)
Comm. Cable - P/N 10-320-0180
Tachometer Cable - P/N 10-320-0181
Optical Probe Bracket - P/N 22-430-0058 or 10-100-0196
Vibration Sensor - P/N 69-100-0016
4MB Ram - P/N 10-10001337
Procedure Card 512 KB - P/N 75-200-0009

5. Ground Safety Precautions

A. General

(1) Great care must be taken, when handling or working on turbine powered aircraft, to avoid injury to personnel and damage to property and engine. Areas of extreme danger are the air intake and exhaust jet wake (Ref. Fig. 501).



C18282

Air Intake and Exhaust Jet Wake Danger Areas
Figure 501

B. Air Intake - Engine Running

(1) The air intake is capable of generating sufficient suction to pull a person into the intake ducting. The potential danger of this suction cannot be overemphasized; in an idling engine it may be sufficient to cause ingestion of eyeglasses, small tools, rags and small objects in general.

C. Exhaust Jet Wake Area - Engine Running

(1) The exhaust jet wake must be approached with extreme caution as extensive damage can be incurred from the high temperature and high velocity gases. At high engine speeds, the jet wake may propel loose dirt, sizeable stones, sand and debris over a considerable distance. The high temperatures in the wake are sufficient to deteriorate asphalt, and for this reason concrete is recommended for run-up areas.

(2) Occasionally, when starting a jet engine, an accumulation of fuel in the exhaust tail pipe is blown out as long streams of flame. Personnel should observe proper fire precautions and move all flammable material to a safe distance.

(3) Exposure to gases in the jet wake should be avoided. Failure to do so may result in respiratory irritations and a burning sensation in the eyes. Particular care should be taken to avoid exposure to gases in confined spaces where the gas concentration may be high.

D. Cool Down

(1) After engine operation, work that requires contact with the exhaust tailpipe should not be carried out for at least one-half hour. Heat resistant gloves must be worn, should work in this area be required immediately after shutdown.

E. Jet Fuel and Lubricating Oil

(1) All jet fuels and lubricating oils have an injurious effect on the skin. Precautions must be taken to avoid contact as much as possible.

6. Test Information

A. Symbols

(1) Symbols have been designated for the working variables used in connection with engine testing. The symbols, referenced to various stations within the engine, and their meaning are described as follows:

Pamb	Ambient Pressure
Tamb	Ambient Temperature
T4.5	Interturbine Temperature
Wf	Fuel Flow
N1	Low Rotor rpm
N2	High Rotor rpm
Θ	T observed/T standard

δ	P observed/P standard
Toil	Oil Temperature
Poil	Oil Pressure

NOTE: Θ and δ are ratios of absolute values.

B. Instrument Accuracy

(1) Instrument accuracy may vary with time. If engine performance numbers change, instrument accuracy should be checked based upon AMM.

C. Engine Operating Limits

(1) Refer to Chapter 5-10-00.

D. Data Plate Information (Ref. Fig. 502)

(1) The following information is contained on the trim data plate located on the bottom of the accessory gearbox.

(a) Engine Serial No.

(b) Build Spec. No.

(c) Trim Balance Weights

(d) N1%.

(e) N2%.

(f) FN/δ (Reference Thrust).

(g) N1 Trim Class.

(h) T4.5 Trim.

(i) VIGV Trim.

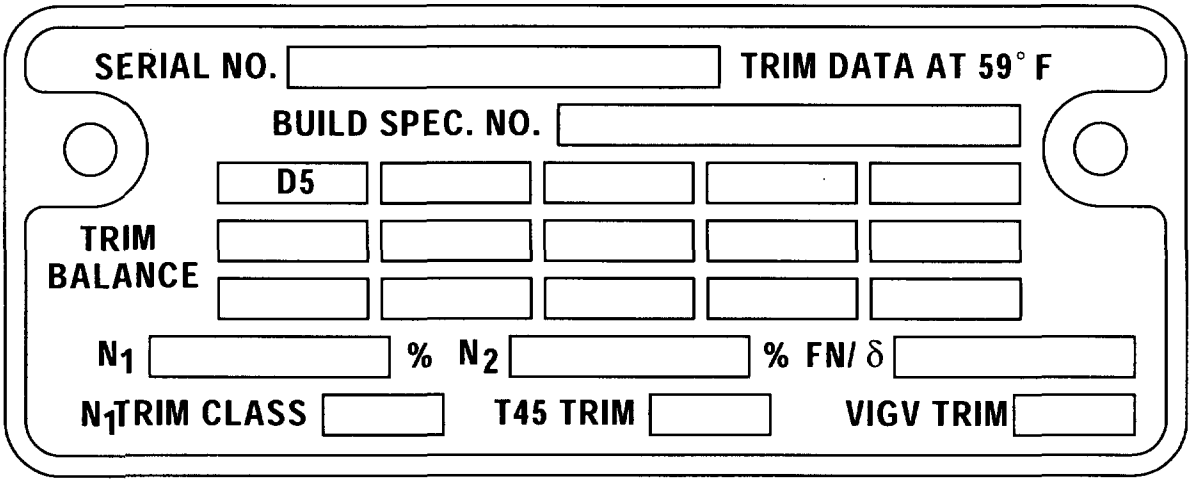
(j) First-stage HP Turbine Rotor (Trim Balance).

(k) Second-stage HP Turbine Rotor (Trim Balance).

(l) LP Compressor Rotor Balance Assembly (Trim Balance).

(2) Interpret engine data plate information as follows (Ref. Fig. 502):

(a) N1 and N2 are the percent speeds (normalized to a standard day) of the low and high pressure rotors when the engine is running in a test cell at the referenced thrust.



C30871

Engine Trim Data Plate - Example
Figure 502

(b) The N1 and T4.5 trims define the offset applied to the actual N1 and T4.5 values to compensate for engine to engine variations for takeoff N1 speed and red-line T4.5 temperature. VIGV trim is not used.

(c) The HP Turbine trim balance defines the trim balance counterweight class and their rivet hole position relative to the HP Turbine disk datum dimple on front (F) or rear (R) plane. This is necessary for field replacement of a HP Turbine disk.

(d) The LP Compressor Rotor trim balance defines the trim balance counterweight class and its rivet hole position on the front balancing rim of the fan hub. This is required if it is necessary to replace a fan in the field (Ref. 72-30-01).

E. Engine Overtemperature

(1) Refer to Chapter 5-10-00.

F. Engine Overspeed

(1) Refer to Chapter 5-10-00.

G. Foreign Object Damage

(1) Refer to Chapter 5-10-00.

H. Fuel

(1) Refer to Chapter 72-00-00.

I. Precipitation

(1) Performance checks should not be attempted during moderate to heavy precipitation or fog. Water entering the engine inlet changes the power output of the engine, the change being proportional to the amount of water ingested. Any form of moisture in the air causes the engine to ingest water. This includes occasions when water or snow is blown into the air inlet, or sucked in by the compressor. Freezing rain or slush snow has exactly the same effect on power output as water ingestion and, in addition, may cling to inlet ducts and upset the flow of air to the engine.

7. Extreme Weather Information

A. Cold Weather Procedure

CAUTION: CAREFULLY MONITOR FUEL AND OIL PRESSURES DURING STARTING OF AN ENGINE WHICH HAS BEEN EXPOSED TO OVERNIGHT LOW AMBIENT TEMPERATURE. SHUT DOWN ENGINE IMMEDIATELY IF, IN EITHER SYSTEM, THERE IS A HIGH OR LOW PRESSURE OUTSIDE OF NORMAL OPERATING LIMITS. INSPECT FOR ICE IN BOTH SYSTEMS. IF PRESENT, APPLY HOT AIR BEFORE ATTEMPTING ANOTHER START.

(1) Solubility of water in fuel diminishes with reducing temperatures resulting in water fuel separation, with the water tending to accumulate at the lowest level of tank, system or affected component. Further temperature reduction or continued cold soaking of the engine causes formation of ice particles which may partially block the fuel system filters, thus reducing fuel flow. In extreme conditions total blockage of the strainer(s) may occur, indicated by a marked reduction or complete loss of fuel flow to the engine. The application of heat to engine and fuel system components will prevent or remedy such instances.

(2) Similar conditions of ice formation can exist in the engine lubrication system due to condensation in the tank or engine case area. Shutting down of a hot engine in low ambient temperature conditions, followed by a cold soak, will certainly increase the probability of ice formation in both fuel and lubrication systems.

B. Hot Weather Procedures

(1) No special precautions or procedures are required for engine starting during hot weather.

8. Engine Ground Checks (Ref. Table 501)

A. Major Component Repair/Replacement Cross Reference

TABLE 501, Ground Checks Required Following Major Component Repair/Replacement

Event	Engine Check No.						Reference
	1	2	3	4	5	6	
Starter Generator Repl.	X	X	X				AMM
Ignition System Component Repl.	X	X	X				74-10-01
Fuel/Oil Heat Exchanger Repl.	X	X	X				79-20-02
Fuel Nozzle Repl.	X	X	X				73-10-04
Fuel Manifold and Lines Repair/Repl.	X	X	X				73-10-04
Fuel Pump Repl.	X	X	X				73-10-02
Fuel Dump Valve Repl.	X	X	X		X		73-10-05
Engine Wiring Harness Repl.	X	X	X				73-20-03
AC Generator Repl.	X	X	X				72-60-01

TABLE 501, Ground Checks Required Following Major Component Repair/ Replacement (Cont'd)

Event	Engine Check No.						Reference
	1	2	3	4	5	6	
IGV Actuator Repl.	X	X	X				75-30-04
EEC Repl.	X	X	X				73-20-02
HMU Repl.	X	X	X				73-20-01
T4.5 Wiring Harness Repl.	X	X	X				77-20-01
P2.5 & P2.8 Bleed Valve Repl.	X	X	X			X	75-30-01
Bleed Valve Solenoid Repl.	X	X	X			X	75-30-02
Anti-ice Solenoid Valve Repl.	X	X	X				75-10-01
H.S.I.	X	X	X	X	X		72-00-00
Combustion Chamber Liner Repl./Repair	X	X	X	X	X		72-40-01
HPT Repl./Repair	X	X	X	X	X		72-50-01
LPT Repl./Repair	X	X	X	X	X		72-50-02
Fan Repl./Repair	X	X	X	X			72-30-01
Exhaust Case Replacement/Repair	X	X	X	X	X		72-50-03
Original or Overhauled Engine Installation	X	X	X	X	X		72-00-00

B. Check No. 1 - Prestart

CAUTION: CHANNEL FORCE SWITCH, IF FITTED, TO BE SET TO AUTO WITH BOTH LANES POWERED.

(1) TLA - CUTOFF.

(2) Engine Master - ON.

(3) Check EEC fault indication lamps for EEC fault.

(4) Fuel System Shut-off switch - FUEL ON.

(5) Fuel Boost Pump switch - ON.

(6) Fuel Inlet Pressure Indicators - Check normal operating limits (if fitted).

(7) Unnecessary Accessory Loads - OFF.

(8) Cabin Bleed and Anti-icing Systems - OFF.

(9) Motive Flow, if fitted - OFF.

C. Check No. 2 - Engine Start

CAUTION: THE IGNITION SYSTEM SHOULD NOT BE ACTIVATED PRIOR TO STARTER SELECTION AND HP ROTOR (N2) ROTATION, TO PREVENT IGNITION OF TRAPPED UNDRAINED FUEL OR VAPORS.

CAUTION: IF THE ENGINE DOES NOT LIGHT-UP WITHIN 10 SECONDS OF ACHIEVING 5.2% N2, RETARD THE TLA TO "CUT-OFF". CONTINUE MOTORING THE HP ROTOR WITH THE STARTER FOR AN ADDITIONAL 15 SECONDS TO CLEAR OUT TRAPPED FUEL OR VAPORS. THE HP ROTOR SHOULD BE ALLOWED TO STOP BEFORE ATTEMPTING ANOTHER START. REPEAT THE STARTING SEQUENCE OBSERVING THE STARTER LIMITS (REFER TO THE APPLICABLE AIRCRAFT FLIGHT MANUAL).

CAUTION: IF N2 REACHES GROUND IDLE WITH NO INDICATION OF N1 ROTATION, ABORT START AND REFER TO CHAPTER 72-00-00, FAULT ISOLATION - 1, Fault Isolation chart for NO N1 SPEED DURING START.

(1) When starting an engine following a normal shutdown, a lock-up of the LP (N1) rotor may occur because of the different cooling rates of the LP Turbine case and the LP Turbine assembly. This is acceptable if:

(a) The engine is otherwise operating normally.

(b) N1 rotation occurs when N2 reaches ground idle.

(2) Ignition - ON or EEC control. For dual ignition exciter system, select single or dual as required.

(3) TLA - IDLE detent or CUTOFF.

NOTE: Advance TLA to IDLE detent prior to 5.2% N2.

(4) Engine Starter Switch - ON.

(5) Monitor ITT and observe that engine accelerates normally to Ground Idle.

(6) Engine Oil Pressure Indicator - Check normal operating limits.

(7) In the event of Auto Start Abort, proceed as follows:

(a) TLA - CUTOFF.

(b) Engine starter switch - OFF.

(c) Recommence Start sequence.

(d) In the event of three consecutive failures of the engine to light-up, refer to Chapter 72-00-00, FAULT ISOLATION - 1, NO LIGHT UP.

(e) After engine has attained Ground Idle:

1 Engine Starter - OFF.

2 EEC Fault Indication - CHECK.

D. Check No. 3 - Engine Shutdown

(1) TLA - IDLE detent.

NOTE: Allow engine to stabilize for a minimum of one minute.

(2) TLA - CUT-OFF detent.

WARNING: IF THERE IS ANY INDICATION OF FIRE WITHIN THE ENGINE AFTER SHUTDOWN, PROCEED AS FOLLOWS:

(3) Engine Master Switch - ON.

(4) Fuel Boost Pump Switch - OFF.

(5) Fuel System Shut-off Switch - FUEL OFF.

(6) Ignition Switches - OFF (if not automatically selected off).

(7) Engine Starter Switch - ON.

(8) Maintain starter operation for desired duration. Observe starter limits (refer to applicable Starter Manufacturers Manual).

(9) Engine Starter Switch - OFF.

(10) Engine Master Switch - OFF.

NOTE: 1. In the event of an internal engine fire, perform borescope inspection per Chapter 72-00-00 and inform P&WC Customer Support.

NOTE: 2. In the event of an external engine fire, as indicated by the nacelle fire warning system, refer to procedures in Aircraft Flight Manual.

E. Check No. 4 - Power Assurance (Ref. Fig. 503, 504 and 505)

(1) Upon initial installation of a new, spare or overhauled engine, a ground power assurance run must be carried out. This establishes the installed relationship between N1, N2 and ITT (T4.5).

(2) The curves obtained from the power assurance run shall be regarded as masters which must be used to assess engine performance margin at subsequent ground checks.

(3) Data on engine performance is to be read from cockpit instruments.

NOTE: Engine performance data can also be read from the EEC via an ARINC 429 data bus. This data can be read by any commercially available ARINC 429 reading device. Additional engine parameters can also be monitored, thus providing more information to determine causes of performance changes. Details of the data available via the ARINC bus are defined in Table 502 and 503. Engine parameters can also be monitored using the Engine Diagnostic System (EDS).

TABLE 502, PW305A ARINC Outputs

Output	Abbreviation	Label (Octal)	Units	Scale Factor	No. Sig. Bits
Inlet Temperature	TTO	130	deg. C	128	11
Ambient Pressure	PAMB	114	psia	32	14
Inlet Pressure	PT	131	psia	32	13
Burner Pressure	P3I	264	psia	512	14
N1 Speed	QBN1I	346	% N1	256	14
N2 Speed	QBN2I	344	% N2	256	14
T45 Temperature	T45	345	deg. C	2048	12
Fuel Flow	WFPPH	347	pph	32768	14
Throttle Lever Angle	TLAI	133	deg. ang.	180	12
N1 Reference	N1REF	341	% N1 nom	256	14
N1 Bug	N1BUG	342	% N1	256	14

NOTE: The transmission rates of the ARINC labels must be specified in the table, however the rate at which the ARINC labels information is updated (except for T45) may be reduced to once per major cycle to reduce processing times. T45 to be updated at 8 times per major cycle.

TABLE 503, PW305B ARINC Outputs

Output	Abbreviation	Label (Octal)	Units	Scale Factor	No. Sig. Bits
Inlet Temperature	TTO	130	deg. C	128	11
Ambient Pressure	PAMB	114	psia	32	14
Inlet Pressure	PT	131	psia	32	13
Burner Pressure	P3I	264	psia	512	14
N1 Speed	QBN1	346	% N1	256	14
N2 Speed	QBN2	344	% N2	256	14
T45 Temperature	T45	345	deg. C	2048	12

TABLE 503, PW305B ARINC Outputs (Cont'd)

Output	Abbreviation	Label (Octal)	Units	Scale Factor	No. Sig. Bits
Fuel Flow	WFPPH	347	pph	32768	14
Throttle Lever Angle	TLAI	133	deg. ang.	180	12
N1 Take Off	N1TOT	340	% N1	256	14
N1 Climb	N1CLT	255	% N1	256	14
N1 Cruise	N1CRT	254	% N1	256	14
N1 Reference	N1REF	341	% N1	256	14
IGV	IGV	366	deg.	180	12
IGVREQ	IGVREQ	367	deg.	180	12

NOTE: The transmission rates of the ARINC labels must be specified in the table, however the rate at which the ARINC labels information is updated (except for T45) may be reduced to once per major cycle to reduce processing times. T45 to be updated at 8 times per major cycle.

(4) If N1 is read from an ARINC device or EDS, adjust the values as follows:

(a) Add N1 Trim Class from data plate to the N1 value as shown below:

N1 Trim Class	%N1
0	0
1	0.47
2	0.94
3	1.41
4	1.88
5	2.36
6	2.83
7	3.30

(5) Ground run engine to obtain power assurance curves as follows:

(a) Make sure instrumentation is functioning correctly and has been accurately calibrated, if necessary.

(b) Obtain trim values for N1, and T4.5 (ITT) from data plate on accessory gearbox and record on data sheet (Ref. Fig. 503).

(c) Position aircraft into wind.

(d) Accomplish a prestart (Ref. Para 8., B.).

(e) Refer to Aircraft Flight Manual to obtain the normal rated take-off % N1 value for the particular outside air temperature (OAT). Record on Figure 503.

TABLE 504, Ambient Temperature Correction Factors for Specified Temperatures

T °C (amb)	Θ	√Θ
–30	0.8438	0.9186
–29	0.8473	0.9205
–28	0.8508	0.9224
–27	0.8542	0.9243
–26	0.8577	0.9261
–25	0.8612	0.9280
–24	0.8647	0.9299
–23	0.8681	0.9317
–22	0.8716	0.9336
–21	0.8751	0.9354
–20	0.8785	0.9373
-19	0.8820	0.9392
-18	0.8855	0.9410
-17	0.8889	0.9428
-16	0.8924	0.9447
-15	0.8959	0.9465
-14	0.8994	0.9483
-13	0.9028	0.9502
-12	0.9063	0.9520
-11	0.9098	0.9538
-10	0.9132	0.9556
-9	0.9167	0.9574
-8	0.9202	0.9593
-7	0.9237	0.9611
-6	0.9271	0.9629
-5	0.9306	0.9647
-4	0.9341	0.9665
-3	0.9375	0.9683
-2	0.9410	0.9701
-1	0.9445	0.9718
0	0.9479	0.9736

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TABLE 504, Ambient Temperature Correction Factors for Specified Temperatures (Cont'd)

T °C (amb)	Θ	$\sqrt{\Theta}$
1	0.9514	0.9754
2	09549	0.9772
3	0.9584	0.9790
4	0.9618	0.9807
5	0.9653	0.9825
6	0.9688	0.9843
7	0.9722	0.9860
8	0.9757	0.9878
9	0.9792	0.9895
10	0.9826	0.9913
11	0.9861	0.9930
12	0.9896	0.9948
13	0.9931	0.9965
14	0.9965	0.9983
15	1.0000	1.0000
16	1.0035	1.0017
17	1.0069	1.0035
18	1.0104	1.0052
19	1.0139	1.0069
20	1.0174	1.0086
21	1.0208	1.0104
22	1.0243	1.0121
23	1.0278	1.0138
24	1.0312	1.0155
25	1.0347	1.0172
26	1.0382	1.0189
27	1.0416	1.0206
28	1.0451	1.0223
29	1.0486	1.0240
30	1.0521	1.0257
31	1.0555	1.0274

TABLE 504, Ambient Temperature Correction Factors for Specified Temperatures (Cont'd)

T °C (amb)	Θ	$\sqrt{\Theta}$
32	1.0590	1.0291
33	1.0625	1.0308
34	1.0659	1.0324
35	1.0694	1.0341
36	1.0729	1.0358
37	1.0763	1.0375
38	1.0798	1.0391
39	1.0833	1.0408
40	1.0868	1.0425
41	1.0902	1.0441
42	1.0937	1.0458
43	1.0972	1.0475
44	1.1006	1.0491
45	1.1041	1.0508
46	1.1076	1.0524
47	1.1111	1.0541
48	1.1145	1.0557
49	1.1180	1.0574
50	1.1215	1.0590

(f) Start engine (Ref. Para. 8., C.).

(g) Check for EEC fault indications and record on Fig. 505.

(h) Make sure all accessory loads are OFF.

(i) Make sure Cabin Bleed and Anti-icing Bleeds are selected OFF.

(j) Allow a minimum of 1 to 2 minutes for engine to establish at ground idle setting. Record on Figure 503 N1, N2, ITT (T4.5), OAT, FUEL FLOW, FUEL PRESS., OIL PRESS., OIL TEMP., VIBRATION LEVEL.

(6) Advance thrust lever to the NORMAL TAKE-OFF detent and allow engine to stabilize for three minutes.

CAUTION: DO NOT EXCEED VALUES OF N2 AND T4.5 PREVIOUSLY DETERMINED. IF EITHER MAXIMUM VALUE IS EXCEEDED, REFER TO CHAPTER 72-00-00, FAULT ISOLATION FOR CORRECTIVE ACTION. FOLLOWING RECTIFICATION REPEAT CALIBRATION CHECK.

(7) Record the following parameters on Figure 503 as obtained from the cockpit instruments for each condition, ie: Normal Take-off (NTO), NTO-2%, NTO-4%, NTO-6%, NTO-10% and Ground Idle:

N1
N2
ITT (T4.5)
OAT
FUEL FLOW
FUEL PRESS.
OIL PRESS.
OIL TEMP.
VIBRATION LEVEL

NOTE: Record fuel flow from cockpit instrumentation.

(8) Shut down engine on completion of power assurance run (Ref. Para. 8., D.).

(9) Make a copy of Figure 504 and plot $N2/\sqrt{\Theta}$ and $T4.5/\Theta$ against $N1/\sqrt{\Theta}$.

(10) Keep the graph of the power assurance result together with the engine logbook for future reference.

(11) A power assurance check is to be carried out after completion of work on gas path components or as required by Major Component Repair/Replacement (Ref. Table 501).

(12) The procedure to be followed is the same as for Engine Calibration, except data is only required for normal take-off condition.

(13) Plot $N2/\sqrt{\Theta}$ and $T4.5/\Theta$ vs $N1/\sqrt{\Theta}$ on the existing calibration curves obtained at ground run on initial installation. Evaluate engine performance and N1, N2, and ITT margins.

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F. Sample Performance Calculation

(1) Examples:

Ambient Temperature (OAT) = 39°C

N1 Speed = 90%

T4.5 Obs. = 700°C

N2 Obs. = 99%

Θ (@39°C) = $\frac{39 + 273.15}{288.15} = 1.0833$

$\sqrt{\Theta} = 1.0408$

$\frac{N1}{\sqrt{\Theta}} = \frac{90}{1.0408} = 86.5\%$

$\frac{N2}{\sqrt{\Theta}} = \frac{99}{1.0408} = 95.1\%$

$\frac{T4.5}{\Theta} = \frac{700 + 273.15}{1.0833} - 273.15 = 625°C$

G. Check No. 5 - Emergency Fuel Shut-off Cable Rigging

(1) Completion of one or more of the following tasks requires complete installation and adjustment (rigging) of the fuel shut-off cable (Ref. 73-10-05):

(a) Repair or replacement of combustion chamber liner and related parts (Ref. 72-40-01).

(b) Repair or replacement of HP turbine and related parts (Ref. 72-50-01).

(c) Repair or replacement of LP turbine and related parts (Ref. 72-50-02).

(d) Repair or replacement of exhaust case and related parts (Ref. 72-50-03).

(2) Installation of an engine on an aircraft requires a dimensional check of the fuel shut-off valve tripper sleeve and fuel shut-off cable as described in Chapter 73-10-05.

H. Check No. 6 - Bleed Valve Operation

(1) Start engine and allow to stabilize at idle.

(2) Check the OAT and look up the BOV steady state closing point in Table 505 (corresponds to 74.5% N2 corrected).

(3) Slowly increase the engine speed until the closing point is achieved.

(4) Check that the BOV(s) close as evidenced by the following:

(a) The N2 speed falling by approximately 2%.

PW305 ENGINE CALIBRATION RUN DATA SHEET

TAKEN FROM INSTALLED CALIBRATED AIRCRAFT EQUIPMENT

DATE:	A/C REG. NO.	ENGINE S/N:	ENGINE POSITION:
ENGINE TOTAL TIME SINCE NEW:		WIND DIRECTION/VELOCITY:	
N1 TRIM CLASS:		T45 TRIM CLASS:	
OUTSIDE AIR TEMP: θ= $\sqrt{\theta}$=		PRESS. ALT:	
MAX N1 FOR AMBIENT CONDITIONS PER A/C FLIGHT MANUALS:			%N1

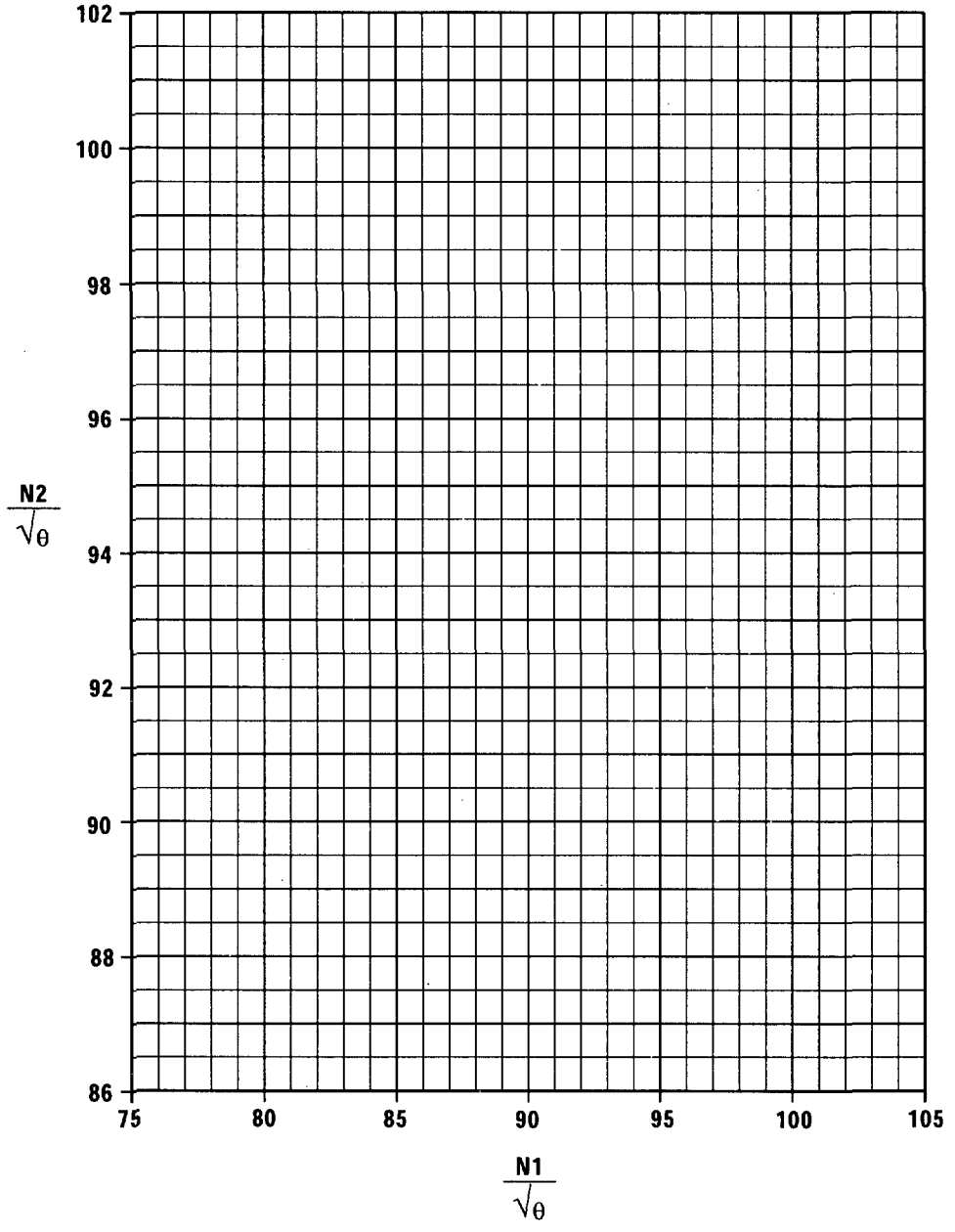
ENGINE PARAMETER (A/C INDICATOR)	SYNC. OFF / BLEED AIR OFF / ANTI-ICE OFF					
	NORMAL T/O	T/O - 2%	T/O - 4%	T/O - 6%	T/O - 10%	GROUND IDLE
N1						
N2						
ITT						
FUEL FLOW						
OIL PRESS						
OIL TEMP						
VIBRATION						
PARAMETER CALCULATION RELATIVE TO ISA SLS						
N1 / $\sqrt{\theta}$						
N2 / $\sqrt{\theta}$						
T45 / θ						

RUN DOWN TIME			
N1:	(SECONDS)	N2:	(SECONDS)

C27239

Engine Calibration Run Data Sheet
Figure 503

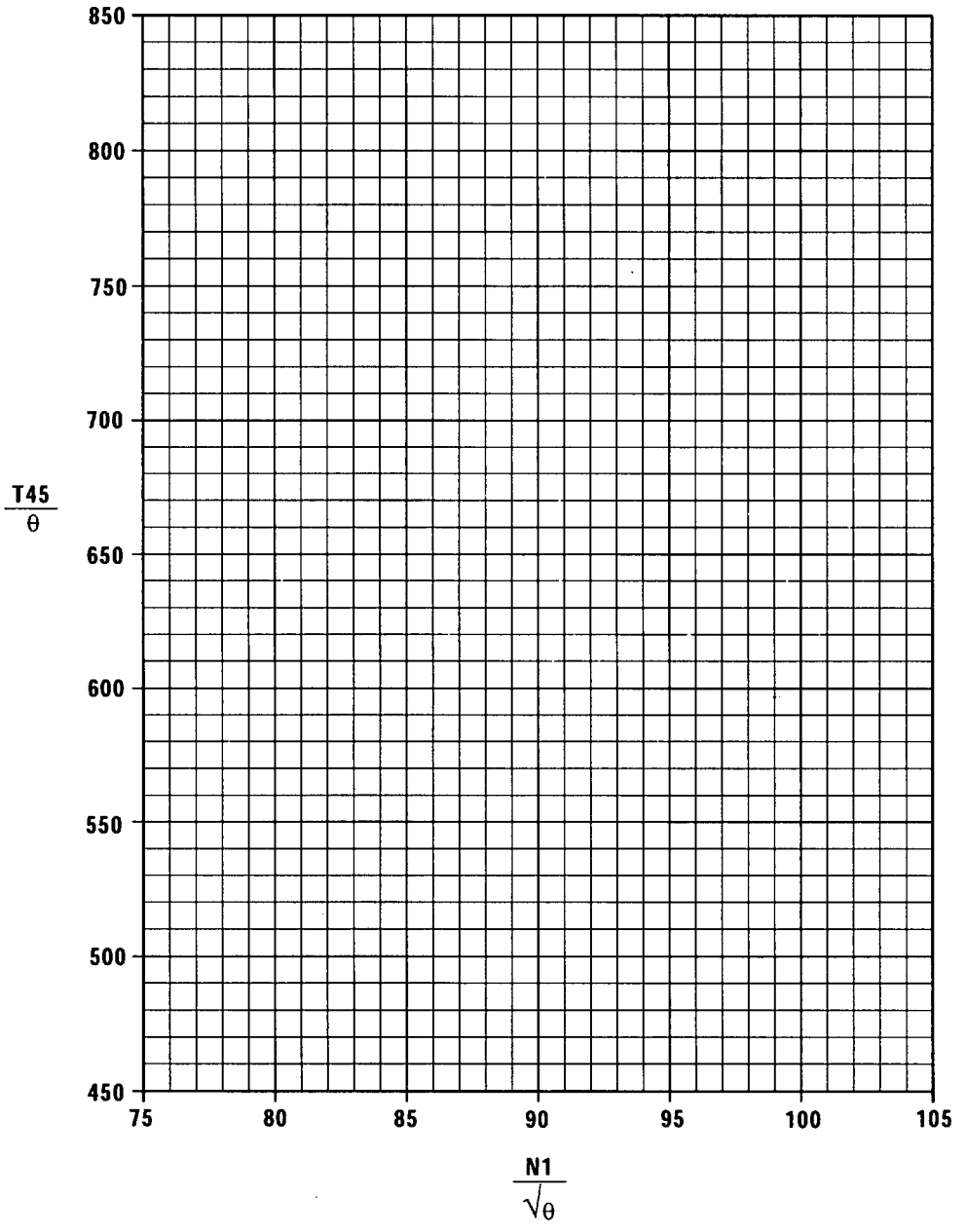
DATE:	A / C REG. NO.:	ENGINE S / N:	ENGINE POSITION:
ENGINE TOTAL TIME SINCE NEW:		ENGINE TOTAL TIME SINCE OVHL:	



C37101

Engine Calibration and Performance Check Curve
Figure 504 (Sheet 1 of 2)

DATE:	A / C REG. NO.:	ENGINE S / N:	ENGINE POSITION:
ENGINE TOTAL TIME SINCE NEW:		ENGINE TOTAL TIME SINCE OVHL:	



C37102

Engine Calibration and Performance Check Curve
Figure 504 (Sheet 2)

EEC FAULT CODE DATA SHEET

EEC S/N:	EEC P/N:	EEC SOFTWARE:

FAULT CODES FROM MULTI-FUNCTION DISPLAY	CHANNEL A	
	CHANNEL B	

C35067

EEC Fault Code Data Sheet
Figure 505

(b) The T45 temperature falling by approximately 40°C.

(5) Slowly reduce the engine N2 speed by approximately 6% to just below the BOV opening point as specified in Table 505.

(6) Check that the BOV(s) open as evidenced by the following:

(a) The N2 speed rising by approximately 2%.

(b) The T45 temperature rising by approximately 40°C.

NOTE: If the TLA is moved too rapidly the BOV(s) may open at a different N2 speed and invalidate the test.

TABLE 505, BOV Operational Check

OAT °C	BOV Closing Point %N2	BOV Opening Point %N2
-60	64.0	59.7
-50	65.5	61.1
-40	67.0	62.5
-30	68.4	63.8
-20	69.8	65.1
-10	71.1	66.4
0	72.5	67.6
10	73.8	68.9
20	75.1	70.1
30	76.4	71.2
40	77.6	72.4
50	78.9	73.6
60	80.1	74.7

I. Check No. 7 - T4.5 Increase of 20°C or More

(1) Record T45, N1, N2 and Fuel Flow from cockpit instruments, for each of the following conditions:

- Ground Idle
- Max. Cruise
- Normal Take-off

(2) Record the condition when a T45 difference of 20°C or more occurs on one engine when compared to the other engine.

(3) Remove LP Bleed Pad Cover (Ref. 75-10-02, MAINTENANCE PRACTICES) and install blanking plate (PWC43430) with new gasket.

(4) Install blanking plate (PWC43435) on HP Bleed Pad.

(5) Disconnect the rudder bias (P2.8) tube and install a 1/4 inch 18 NPT pipe plug in its place.

(6) Start engine and allow to stabilize at Ground Idle for 1 to 2 minutes and record N1, N2, Fuel Flow and T45.

(7) Slowly advance thrust lever to the Max. Cruise setting and stabilize for 1 to 2 minutes and record N1, N2, Fuel Flow and T45.

(8) Slowly advance thrust lever to the Normal Take-off setting and stabilize for 1 to 2 minutes and record N1, N2, Fuel Flow and T45.

(9) Check if a T45 difference of 20°C or more occurred on one engine when compared to the other engine, for each of the 3 power settings.

(10) If a difference in T45 occurred, refer to the Fault Isolation chart for an Increase in Normal T45 Temperature (Ref. 72-00-00, FAULT ISOLATION-1, Operating Problems - Increase in Normal T45 Temperature).

(11) If a difference in T4.5 did not occur, refer to the Aircraft Maintenance Manual for Fault Isolation of the Environmental Control System.

9. Motoring Runs

A. Dry Motoring Run (PW305A)

NOTE: This procedure is used to clear the engine any time during ground operation to purge the engine of trapped fuel or vapors. The air passing through the engine will remove fuel or vapors from the combustor, turbines and exhaust nozzle.

(1) Thrust Lever Angle - CUTOFF.

(2) Ignition Switches - OFF and Pull Ignition Circuit Breakers.

(3) Battery Switches - ON.

(4) Engine Starter Switch - ON.

(5) Maintain starter operation for the desired duration. Normally 30 seconds. Observe starter limits (refer to applicable Starter Manufacturer's Manual).

(6) Engine Starter Switch - OFF.

(7) Battery Switches - OFF.

(8) Observe starter cool-down period (refer to applicable Starter Manufacturer's Manual prior to attempting further starting operations).

(9) Re-set all circuit breakers pulled during the check(s).

B. Dry Motoring Run (PW305B)

NOTE: The following procedure is used to clear the engine at any time during ground operation when it is deemed necessary to purge the engine of internally trapped fuel and vapors. Air passing through the engine serves to remove fuel or vapor from the combustor area, turbines and engine exhaust nozzle.

(1) TLA - CUT-OFF.

(2) Ignition Switches - OFF.

(3) Engine Master Switch - ON.

(4) Engine Starter Switch - ON.

(5) Maintain starter operation for the desired duration. Normally 15 seconds. Observe starter limits (refer to applicable Starter Manufacturer's Manual).

(6) Engine Starter Switch - OFF.

(7) Engine Master Switch - OFF.

(8) Observe starter cool-down period (refer to applicable Starter Manufacturer's Manual prior to attempting further starting operations).

C. Wet Motoring Run (PW305A)

WARNING: CHANNEL FORCE SWITCH, IF FITTED, TO BE SET TO AUTO WITH BOTH LANES POWERED.

CAUTION: THIS PROCEDURE IS USED STRICTLY FOR MAINTENANCE PURPOSESONLY AND IS NOT PART OF NORMAL START PROCEDURES. AFTER A WET MOTORING RUN, A DRY MOTORING MUST BE ACCOMPLISHED BEFORE ANY START IS ATTEMPTED.

(1) Thrust Lever Angle - CUTOFF.

(2) Battery Switches - ON.

(3) Check EDS fault indication lamps for EDS fault.

(4) Unnecessary Accessory Loads- OFF.

(5) Engine Bleed Air - OFF.

(6) Ignition Switches - OFF and pull ignition circuit breakers.

(7) Engine Starter Switch - ON.

(8) Thrust Lever Angle - Idle Detent.

(9) Maintain starter operation for the desired duration. Normally 30 seconds. Observe starter limits (refer to applicable Starter Manufacturer's Manual).

(10) Thrust Lever Angle - CUTOFF.

(11) Engine Starter Switch - OFF.

(12) Battery Switches - OFF.

(13) Observe starter cool-down period (refer to applicable Starter Manufacturer's Manual prior to attempting further starting operations).

(14) Do a Dry Motoring Run.

D. Wet Motoring Run (PW305B)

CAUTION: THIS PROCEDURE IS USED STRICTLY FOR MAINTENANCE PURPOSES AND IS NOT PART OF NORMAL START PROCEDURES. AFTER A WET MOTORING RUN, A DRY MOTORING MUST BE ACCOMPLISHED BEFORE ANY START IS ATTEMPTED.

(1) Accomplish prestart Check No. 1.

(2) Ignition Switches - OFF.

(3) Engine Starter Switch - ON.

(4) TLA - IDLE detent. Maintain starter operation for desired duration. Observe starter limits (refer to applicable Starter Manufacturer's Manual).

(5) TLA - CUT-OFF.

(6) Engine Starter Switch - OFF.

(7) Fuel Boost Pump Switch - OFF.

(8) Fuel System Shut-off Switch - FUEL OFF.

(9) Engine Master Switch - OFF.

(10) Allow starter to cool for specified period, then accomplish a dry motoring run.

E. Emergency - Ground Fire

(1) TLA - CUT-OFF.

(2) Engine Master Switch - ON.

(3) Fuel Boost Pump Switch - OFF.

(4) Fuel System Shut-off Switch - OFF.

(5) Engine Starter Switch - ON.

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(6) Maintain starter operation for the desired duration. Observe starter limits. (Refer to the applicable Aircraft Flight Manual).

(7) Engine Starter Switch - OFF.

(8) Engine Master Switch - OFF.

(9) Allow the starter to cool before any further starting operation is attempted.

10. Adjustments

A. Engine Oil Pressure Adjustment (Pre-SB24367/Pre-SB24395) (Ref. Figs. 506 and 508)

(1) Shut down engine.

(2) Remove two nuts (1) and remove cover (2) using puller (PWC43172). Remove and discard preformed packing (3).

(3) Adjust valve stem (4) using screwdriver, clockwise to increase pressure or counterclockwise to decrease pressure.

NOTE: One quarter turn of the valve will change oil pressure approximately 3 psi.

(4) Install new preformed packing (3) on cover (2) and install on housing with nuts (1). Tighten and torque 27 to 30 lb.in. (3.0-3.4 Nm).

(5) Start engine and stabilize for five minutes, check oil pressure (Ref. Fig. 508). Repeat procedure as required.

B. Engine Oil Pressure Adjustment (Post-SB24367/Post-SB24395) (Ref. Fig. 507 and 508)

(1) Shut down engine.

(2) Remove two nuts (1) and remove cover (3), using puller (PWC43172). Remove and discard preformed packing (4).

(3) Adjust sleeve (5) using a 7/8 inch open-end wrench, clockwise to increase pressure or counterclockwise to decrease pressure.

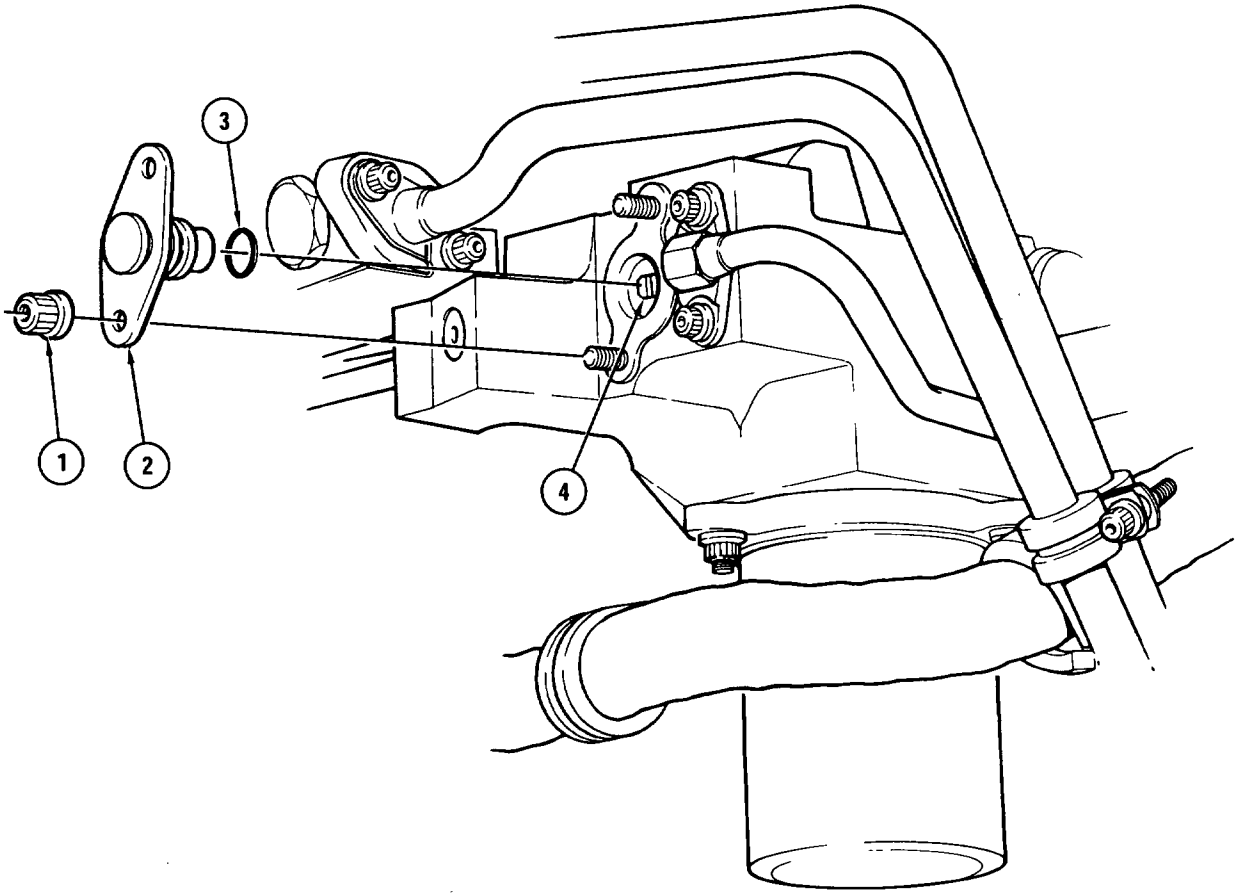
NOTE: One eighth turn (one flat) of the sleeve will change oil pressure approximately 3 psi.

(4) Install new preformed packing (4) on sleeve (5) and install valve cover (3) on housing with nuts (1). Tighten and torque 27 to 30 lb.in. (3.0-3.4 Nm).

(5) Start engine and stabilize for five minutes, check oil pressure (Ref. Fig. 508). Repeat procedure as required.

C. IGV Actuator Rigging

(1) Refer to Chapter 75-30-04.



C18677

Oil Pressure Adjusting Valve - Pre-SB24367/Pre-SB24395
Figure 506

Key to Figure 506

1. Self-locking Nut
2. Cover
3. Preformed Packing
4. Valve Stem

11. In-situ Fan Trim Balancing - ACES Model 1700 Analyzer

A. General

Current engine balancing procedures, carried out during engine build, includes a requirement to trim balance the complete LP compressor assembly during engine test. This is achieved by the installation of counterweights to the specific position in the fan hub assembly. Similarly, for field replacement of the fan assembly, trim balancing of the fan assembly may be necessary if a high vibration indication is noted.

The operator must be familiar with the ACES Model 1700 Analyzer before performing these operations. Accomplish vibration survey and fan trim balance operation using the following procedures and the ACES Operator's Manual.

Refer to the FAULT ISOLATION - OPERATING section of this manual to determine when engine in-situ trim balance should be accomplished.

Required equipment listed in Fixtures, Equipment and Supplier Tools at the front of this section has been approved for use in determining position and mass of trim balance weight. Other equipment may be approved on a case by case basis.

B. Installation of Vibration Sensor (Ref. Figs. 509 and 510)

(1) Gain access to top area of the LP compressor case/intermediate case (Flange B) and locate the two adjacent nuts at 12 o'clock position.

(2) Remove two nuts (5, Fig. 509) and washers (3) from Flange B location.

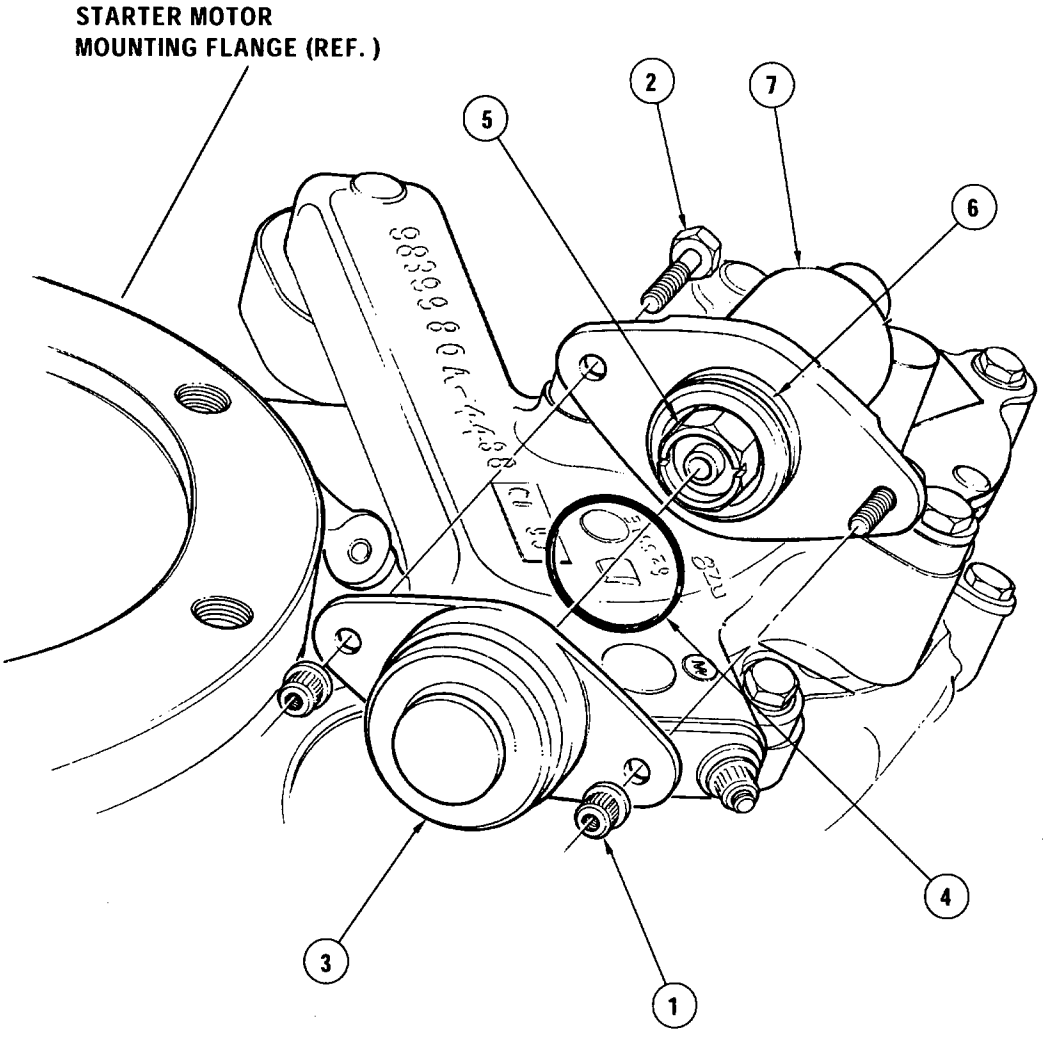
(3) Install sensor (1) with mounting bracket (2) (PWC43442) using two washers (3) and two nuts (5).

(4) Torque nuts 62 to 72 lb.in (7.1-8.1 Nm).

CAUTION: KEEP VELOCITY CABLE AWAY FROM HOT BLEED AIR AND OIL LINES.

(5) Install high temperature cable (1, Fig. 510) P/N 10-320-0008 connector to vibration sensor (15) P/N 69-100-0016. Torque connector 50 to 60 lb.in. (5.7-6.7 Nm). Connect the other end of the cable to converter box (2) P/N 10-100-1500.

(6) Connect the vibration sensor cable (3) P/N 10-320-0131 to the other receptacle of the converter box (2) and connect the other end of the cable to the VELOCITY receptacle of the Aces Analyzer (6).



C24505A

Oil Pressure Adjusting Valve - Post-SB24367/Post-SB24395
Figure 507

Key to Figure 507

1. Nut
2. Bolt
3. Cover
4. Preformed Packing
5. Adjustable Sleeve
6. Oil Pump Cover (Ref.)

C. Installation of Optical Tachometer Probe (Ref. Fig. 510 and 511)

(1) Remove P1/T1 probe from its mounting point in the inlet cowl and secure to the cowling area (Ref. Fig. 511).

(2) Install optical tachometer probe (12, Fig. 510) P/N 10-100-1773 or P/N 10-100-1300 with bracket (11) P/N 22-430-0058 or P/N 10-100-0196 respectively, on the P1/T1 probe mounting point.

CAUTION: FASTEN CABLE TO AIRFRAME TO AVOID ENGINE INGESTION AND HOT AIR AND OIL LINES.

(3) Connect tachometer probe cable (13) P/N10-320-0126 to the optical probe (12) and the other end to the receptacle marked 'PHOTO' on the speed unit (7) P/N10-100-0485.

D. Installation of N2 Extension Cable (Ref. Figs. 510 and 512)

(1) Disconnect the P9 connector from the N2 speed sensor (4, Fig. 512) and connect an N2 speed breakout splitter (5) P/N10-320-0167 to the N2 speed sensor (4).

(2) Connect the P9 connector to one of the two connectors of the N2 splitter (9, Fig. 510).

(3) Connect the N2 extension cable (9, Fig. 510) P/N10-320-0171 connector to the other connector of the splitter (9).

(4) Connect the other end of the N2 extension cable (8) to the receptacle marked 'N2' on the speed unit (7) P/N10-100-0485.

E. Hook-up Speed Unit to Aces Analyzer (Ref. Fig. 510)

(1) Connect the receptacle marked COMM on the speed unit (7) P/N10-100-0485 and the receptacle marked "COMM' on the analyzer (6) Aces Model 1700 using communication cable (5) P/N10-320-0180.

(2) Connect the two receptacles marked TACHO on the speed unit (7) and the analyzer (6) using tachometer cable (4) P/N10-320-0181.

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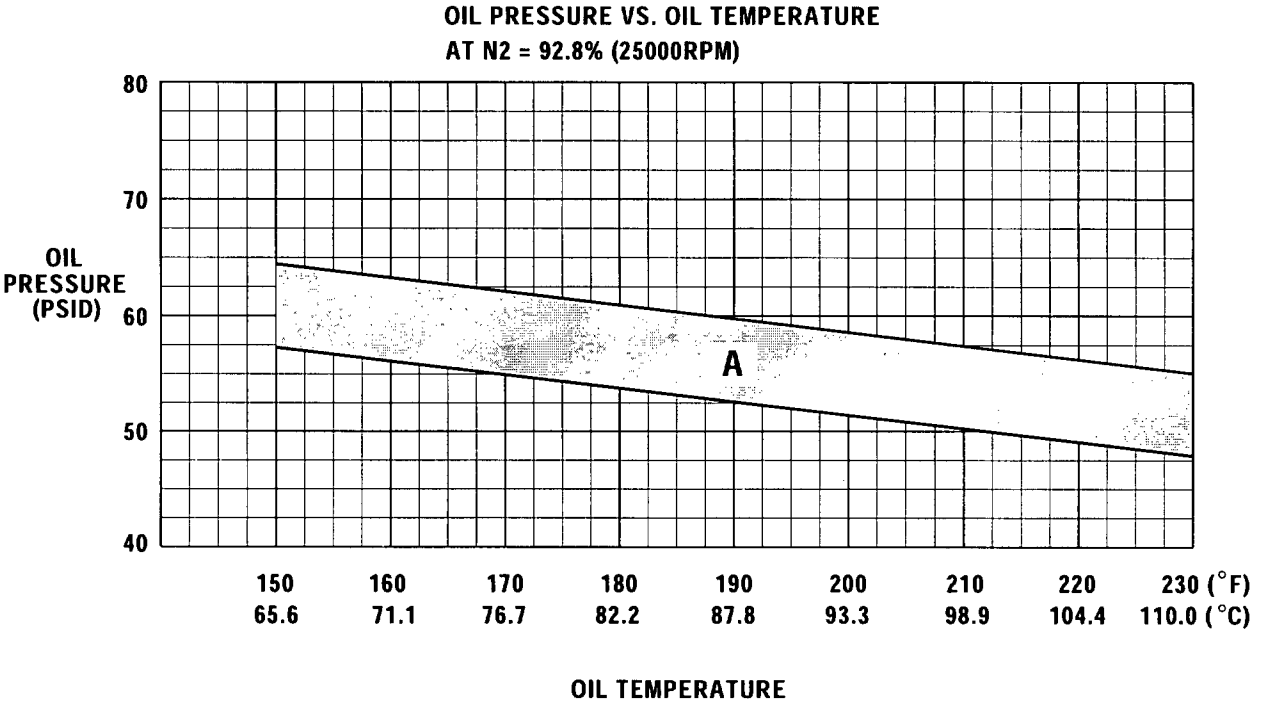


AREA **A** : ACCEPTABLE RANGE

C18674C

Oil Pressure Adjustment Chart
Figure 508

F. Installation of Reflective Tape on Inlet Cone (Ref. Fig 513)

CAUTION: MATERIAL OF FAN ASSEMBLY IS TITANIUM. HANDLE WITH EXTREME CARE USING CLEAN, LINT-FREE GLOVES.

(1) Locate a fan blade marked (TDC) that is in line with a 'V' mark on the inlet cone and mark a line on the blade platform using an approved silver pencil (PWC05-018).

CAUTION: CLEANED AREA MUST BE IN LINE WITH THE 'V' MARK AND DIRECTLY IN PASSING VIEW OF THE OPTICAL PROBE AS THE FAN ASSEMBLY ROTATES.

(2) Clean the area of the inlet cone where the tape is to be attached, with acetone (PWC11-012).

CAUTION: POSITION THE REFLECTIVE TAPE SO THE LEADING EDGE OF THE TAPE IS RELATIVE TO THE OPTICAL PROBE, TO ENSURE THE ARRANGEMENT TRIGGERS THE TACHOMETER LED.

(3) Install a two-inch piece of reflective tape (PWC05-238) one inch wide, or two one-half inch wide pieces on the cleaned area fan inlet cone.

(4) Apply a light coat of locking and retaining compound (PWC09-002) around the edges of the tape, and between the two pieces.

(5) Supply power to analyzer and check that the tachometer triggers when No. 1 blade is at TDC.

G. Vibration Survey

CAUTION: DO NOT ACCELERATE THE ENGINE PAST THE N1 SPEED DURING THE SURVEY.

CAUTION: DO NOT EXCEED ANY ENGINE OPERATING LIMIT WHEN TRIM BALANCING. IF ANY N1 SETTINGS WILL CAUSE THE ENGINE TO EXCEED AN OPERATING LIMIT OMIT THAT POINT OR POINTS.

(1) Determine engine maximum N1% RPM for local pressure altitude and ambient temperature from Aircraft Flight Manual.

(2) Install maintenance-level P&WC Fan Vib Survey RAM procedure card in the ACES analyzer. Switch the power on and load the procedure into the analyzer. Select PW305 engine model and engine survey options from prompts, and enter other required information.

NOTE: 1. Do not install overhaul level procedure card.

NOTE: 2. Make sure the battery charge indication is more than 40%.

CAUTION: MAKE SURE THE INFORMATION ON THE ANALYZER SCREEN IS CORRECT BEFORE PRESSING ENTER

(3) At Operation Options menu, select P&WC Fan Vib Survey v2.20 (or greater) option using the POINT keys and press ENTER.

NOTE: 1. Instructions are given on the bottom of the ACES analyzer screen.

NOTE: 2. The existing ACES 1700 Analyzer labeled POINT and MACHINE keys are correspondingly marked with arrows i.e. upper/lower arrows for POINT keys and left/right arrows for MACHINE keys. The latest ACES 1700 Model may not have the POINT/MACHINE labels but simply the arrow markings.

(4) At the Main menu, select Perform Engine Survey using the POINT keys and press ENTER.

(5) At the Engine Survey menu, select Start Engine Survey using the POINT keys and press ENTER.

(6) At the Survey Information menu, select the Engine Model PW305 using the MACHINE keys and press POINT down.

(7) Enter the Engine Serial No. using the MACHINE and POINT keys.

(8) Enter the Engine Hours using the keypad keys and press down.

(9) Enter the Engine Cycles using the keypad keys and press down.

(10) Select the Plane to Test "1" using the MACHINE keys and press POINT down

(11) Select the 6222m7/TEC using the MACHINE keys and press POINT down.

(12) Select the N1 Tach Type "Optical" using the MACHINE keys and press POINT down.

(13) At this point review all the information on the screen from steps (6) to (12) and make any changes as required and press ENTER. The ACES 1700 screen will display the real-time data on the screen which consist of the following:

Block Acquired: n
Ovrl: n.nnn in/sec AVG
N1: nnnnnn; N2: nnnnnn

(14) Start engine (Ref. Para. 8., C.) and allow engine to stabilize and engine oil temperature to reach a minimum of 51°C (125°F).

NOTE: If required, run engine at higher idle speed to warm engine oil, then return power lever to idle.

(15) Press ENTER to start recording.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS. MAINTENANCE MANUAL ENGINE OPERATING LIMITS SUPERSEDE ANY INSTRUCTIONS IN THE ACES ANALYZER PROCEDURE.

(16) Accelerate engine from idle to takeoff power at approximate rate of 0.5% N1 per second. When takeoff N1 is reached press ENTER to end the survey. The ACES 1700 analyzer will display the Processing Spectra. This process will take several minutes.

(17) End the vibration survey after the engine reaches maximum N1. Press ENTER to stop the analyzer recording.

(18) Decelerate the engine to idle.

(19) Select the Review Engine Survey using the POINT keys and press ENTER.

(20) Select the View Survey using the POINT keys and press ENTER. The screen will display the surveys that are available. Locate the correct survey using the POINT keys and press ENTER.

(21) At the Plot Survey menu, select VIEW 1EN1 Vibration using the POINT keys and press ENTER. The screen will display the fan vibration plot (Ref. Fig. 514). The plot indicates the peak level at the corresponding N1 speed.

(22) Record the peak amplitude RPM value.

(23) Shut down the engine (Ref. Para. 8.).

(24) View all plots from the Plot Survey menu. Print the plots by selecting Print Survey (1.0 ips). For print set-up, connect printer ZTHERMAL PRINTER to COMM port on the ACES 1700 by using Lap Link/Print cable 75-800-0020.

(25) From the rpm at peak vibration (Ref. Fig. 514 Sheet 3) determine the five N1 power settings to be used for trim balancing as follows:

SPEED 1 = (Peak N1 RPM - 500 RPM)
SPEED 2 = (Peak N1 RPM - 250 RPM)
SPEED 3 = (Peak N1 RPM)
SPEED 4 = (Peak N1 RPM + 250 RPM)
SPEED 5 = (Peak N1 RPM + 500 RPM)

(26) Install maintenance PW300 Series RAM procedure card in the ACES analyzer. Switch the power on and load the procedure into the analyzer.

NOTE: 1. Do not install overhaul level procedure card.

NOTE: 2. Make sure the battery charge indication is more than 40%.

H. Initial Fan Balance Run

(1) Remove the inlet cone (Ref. 72-30-01).

(2) Record the location of the counterweights on the front balancing rim in the Fan Trim Balancing Data Worksheet (Ref. Fig. 515).

(3) Install the inlet cone (Ref. 72-30-01).

CAUTION: MAKE SURE THE INFORMATION ON THE ANALYZER SCREEN IS CORRECT BEFORE PRESSING ENTER

(4) At the Operation Options menu, select PW305 engine family using the POINT keys and press ENTER.

(5) Select PW305 engine model using the POINT keys and press ENTER.

(6) At the main menu, select BALANCE FAN using the POINT keys and press ENTER.

(7) At the FAN BALANCE menu, select START BALANCE PROCEDURE using the POINT keys and press ENTER.

NOTE: The new balance job will terminate the job. Use "RESUME TO START" since you are balancing an engine for the first time. Answer YES to the question OK TO PROCEED. If you want to review a previous job, answer NO and press ENTER.

(8) At Balance Information Menu enter the engine serial number as follows:

(a) Use the POINT/MACHINE keys to enter the first three letters/numbers on the left. Use the MACHINE keys to scroll up and down. Use the POINT keys to move to the left or right.

(b) Press the lower POINT key to move to the last four numbers.

(c) When the area for last four numbers is highlighted, press CLR and use the number keys to enter the remainder of the engine serial number.

(9) Select the 6222m7/TEC and set the Input Range to AUTORANGE then press ENTER.

NOTE: Use the lower POINT key to move down the menu, and the MACHINE keys to view the options.

(10) At the Fan Balance Speed menu use the number keys to set balance speed to peak vibration N1 rpm determined from the vibration survey. Press ENTER.

NOTE: The aces analyzer will calculate the speed as a percentage.

(11) The next screen will confirm rpm and percentage. Select YES if correct and press ENTER.

(12) At the next screen counterweight hole locations (numbered 1 to 40) are displayed. Input the location of the counterweights on the front balancing rim recorded at step (2). Use the POINT keys to select the hole numbers and the MACHINE keys to activate the existing counterweight location (an "X" appears at the counterweight location).

(13) Select CURSOR HERE WHEN DONE and press ENTER.

(14) The ACES analyzer will review the number of detail counterweights and ask if you want to review the detail counterweight locations.

(15) Answer NO if the locations are correct and you wish to proceed. Answer YES if you wish to review or change the locations.

(16) Start the engine. Let the engine stabilize and oil temperature reach 51°C (125°F) minimum. Press ENTER.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS. MAINTENANCE MANUAL ENGINE OPERATING LIMITS SUPERSEDE ANY INSTRUCTIONS IN THE ACES ANALYZER PROCEDURE.

(17) The analyzer will display the peak vibration N1 speed minus 500 RPM (Ref. step (10)). Bring the engine to this speed and press ENTER. At the next display, allow 10 to 15 seconds for the phase and amplitude to stabilize, then press ENTER to accept the measuring point. The analyzer will display the next speed (Peak N1 minus 250 rpm) Repeat the procedure for the following N1 rpm settings.

SPEED 1 = (Peak N1 RPM - 500 RPM)
SPEED 2 = (Peak N1 RPM - 250 RPM)
SPEED 3 = (Peak N1 RPM)
SPEED 4 = (Peak N1 RPM + 250 RPM)
SPEED 5 = (Peak N1 RPM + 500 RPM)

NOTE: At each speed, make sure that the engine rpm agrees with the speed requested by the analyzer and that the phase measurement indicated is fairly stable. If the engine speed changes by ± 50 rpm, press the CLR key and start a new average.

(18) Record the position of the counterweight hole defined by the analyzer.

(19) Return the engine to idle speed.

(20) Shut down the engine.

(21) At the VIBRATION SUMMARY menu answer YES to the question CONTINUE TO BALANCE.

I. Trial Weight Trim Balance Run

(1) Review trim balance mass and location solution defined by ACES analyzer.

NOTE: Trim balance counterweight rivet hole locations are counted counterclockwise from the inlet cone index 'V' mark.

(2) Install trial counterweight as follows:

(a) Remove inlet cone (Ref. 72-30-01).

(b) Record the class and location of the existing counterweights on the fan front balancing rim. This information is required if the solution counterweight location given by the analyzer is occupied by an existing counterweight, and a split weight option is required.

NOTE: The trim balance counterweight mass and position defined by the ACES analyzer is called the solution.

(c) Install class of counterweight closest to trial solution defined by analyzer at indicated fan balance location (Ref. Para. 13. - Rivet and Counterweight). Do not install a trial weight heavier than required. Classes are listed in the Table below:

Class	Ref. Weight Including Rivet (grams)
CL1	2.01
CL2	2.51
CL3	2.98
CL4	3.52
CL5	4.06
CL6	5.18
CL7	7.32
CL8	10.45

(d) After the trial counterweight has been installed, press ENTER to continue.

(e) At the FAN INSTALLED WEIGHTS menu, press ENTER if the trial counterweight is installed in the positions defined by the analyzer .

(f) If the trim counterweight is installed in a hole other than the defined hole, change the class and location on the ACES analyzer using the POINT/MACHINE keys. Record this information.

(g) The ACES analyzer will review the solution and ask for confirmation. If satisfactory answer NO to the question RE-ENTER WEIGHTS.

(h) Install the inlet cone (Ref. 72-30-01).

(3) Perform trial counterweight run as follows:

(a) Start the engine. Let the engine stabilize and oil temperature reach 51°C (125°F) minimum.

(b) Repeat step H.(17) and check new vibration level. The ACES analyzer will provide the solution counterweight and angle.

NOTE: The analyzer calculates final or successive solutions based on previous trial trim weight having been removed.

(c) Return the engine to idle speed.

(d) Shut down the engine.

(4) If vibration level is within acceptable limits, end balance procedure. Proceed to step (9).

(5) If vibration level is not acceptable, observe new counterweight size and rivet hole location calculated by analyzer.

(6) Remove first trial weight and install solution counterweight as follows (Ref. Para. 13. - Rivet and Counterweight):

NOTE: 1. The analyzer calculates final or successive solutions based on previous trial counterweight having been removed.

NOTE: 2. Unbalance is corrected by using a maximum of four counterweights, including those used for detail balancing. Counterweights may be added or existing fan detail counterweights may be replaced

(a) Remove the inlet cone (Ref. 72-30-01).

(b) If solution counterweight location is occupied by an existing counterweight, proceed as follows:

1 Select SPLIT WEIGHT option.

2 Enter available locations recorded in stepl.(2) (b), the analyzer will display a correction at available locations.

(c) Remove the class 5 trial counterweight and install solution weight/s (Ref. 72-30-01) as defined by the analyzer (Ref. Para. 13. - Rivet and Counterweight).

(d) Enter the position and class of the SOLUTION counterweight and rivet into the ACES analyzer. Record this information.

NOTE: The aces analyzer will suggest three available holes, select the middle hole by making the unwanted holes zero using the POINT/MACHINE keys.

(e) At the FAN INSTALLED WEIGHTS menu enter the hole locations occupied by counterweights at SOLUTION WAS and INSTALLED IS and RE-ENTER WEIGHTS prompts.

(f) If an incorrect weight or position was entered, select YES using the POINT/MACHINE keys and press ENTER. If the correct weight and position was entered select NO and press ENTER.

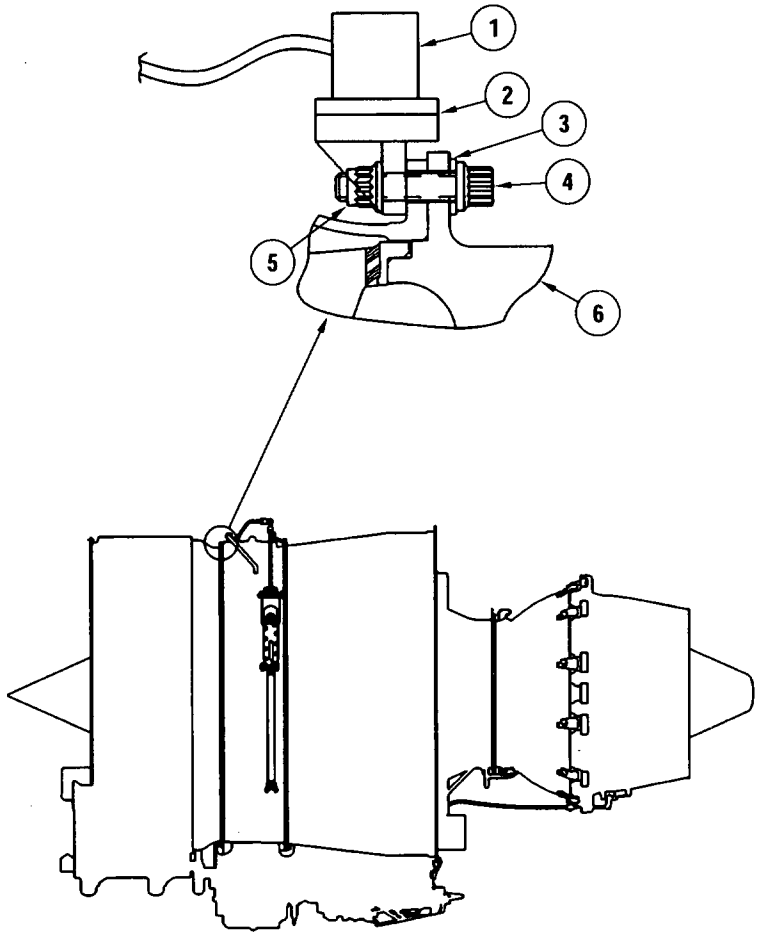
(g) Install the inlet cone (Ref. 72-30-01).

(7) Perform vibration survey (Ref. Para. G.). If increased vibration levels are observed in the 7000 to 11000 cycles per minute range, remove weight and repeat procedure.

(8) When engine vibration is within acceptable limits, record trim weight mass and position, with respect to fan hub V-mark, in engine log book.

(9) Remove test equipment and return engine to normal operation condition.

P&WC Proprietary Information. Subject to the restrictions on the title page.



C65492

Installation of Vibration Sensor
Figure 509

Key to Figure 509

1. Vibration Sensor
2. Bracket
3. Washer
4. Bolt
5. Self-locking Nut
6. Intermediate Case (Ref.)

12. In-situ Fan Trim Balancing - TEC Model 4040 Viper Analyzer

A. General

Current engine balancing procedures, carried out during engine build, includes a requirement to trim balance the complete LP compressor assembly during engine test. This is achieved by the installation of counterweights to the specific position in the fan hub assembly. Similarly, for field replacement of the fan assembly, trim balancing of the fan assembly may be necessary if a high vibration indication is noted.

The operator must be familiar with the TEC Model 4040 Viper Analyzer, P/N 10-100-4040 before performing these operations. Do a vibration survey and fan trim balance operation with the following procedures and the Viper Operator's Manual.

Refer to FAULT ISOLATION 1 - OPERATING section of this manual to determine when engine in-situ trim balance should be done.

Required equipment, including the optional TEC Model 4040 Viper Notebook Cable - P/N 10-320-0157, found in the Fixtures, Equipment and Supplier Tools List at the front of this section have been approved for use in determining position and mass of trim balance weight. Other equipment may be approved on a case by case basis.

B. Installation of Vibration Analysis Equipment (Ref. Fig 516)

(1) Install the vibration sensor (Ref. Procedure 11. Para B.).

(2) Install the charge converter box 10-100-0574 and cable 10-320-0431.

(3) Install the optical probe (Ref. Procedure 11. Para C.).

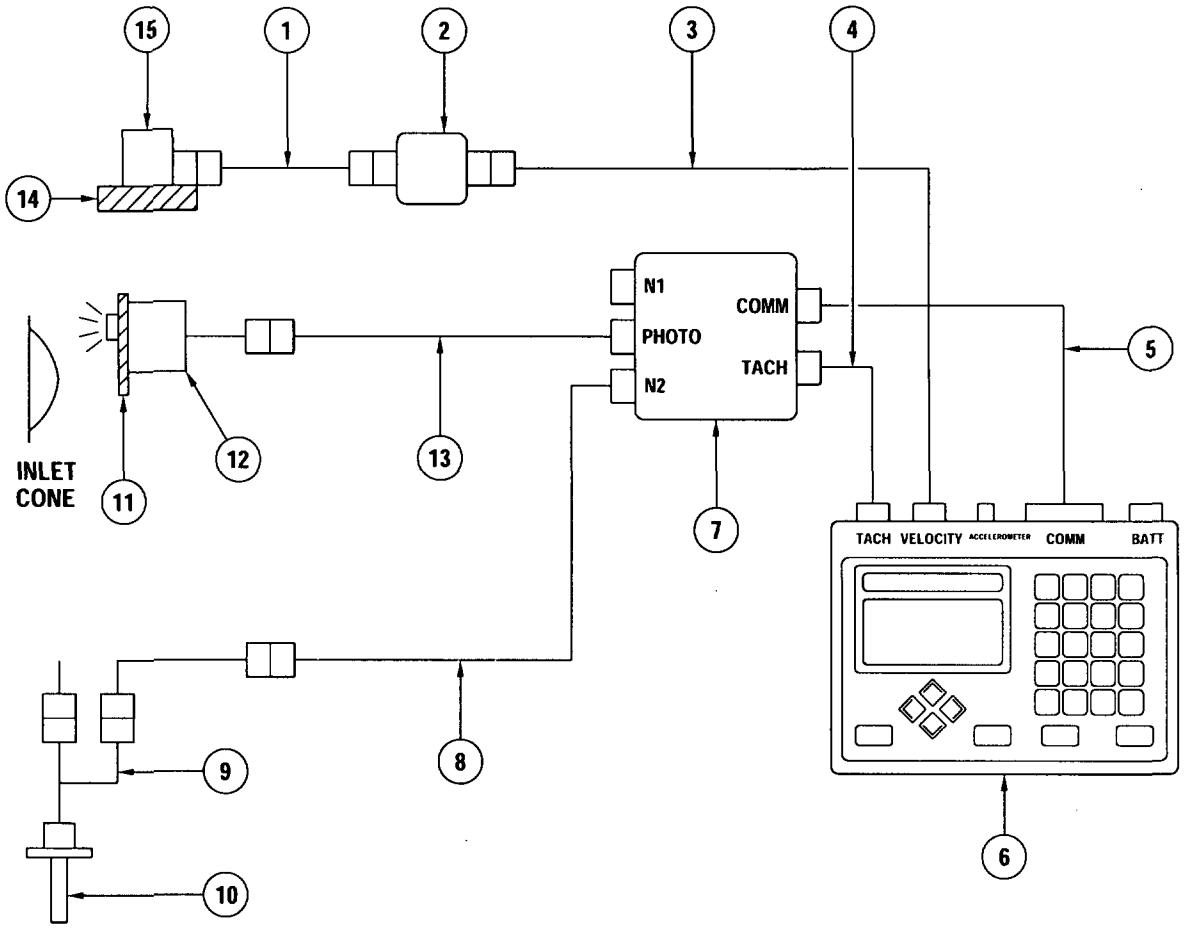
(4) Disconnect the P9 connector from the N2 speed sensor and connect an N2 speed breakout 10-320-0167 to the N2 speed sensor.

(5) Connect the P9 connector to the N2 speed breakout.

(6) Connect the N2 breakout extension cable 10-320-0471 to the N2 speed breakout and to the N2 receptacle of the TEC Model 4040 Viper Analyzer, P/N 10-100-4040.

(7) Connect the tach cable 10-320-0126 and channel A connectors to the appropriate receptacles of the TEC Model 4040 Viper Analyzer, P/N 10-100-4040 connectors.

(8) Install reflective tape on the nose cone (Ref. Procedure 11. Para F.).



C65490B

Installation Schematic of Vibration Analysis Equipment - ACES Model 1700 Analyzer
Figure 510

Key to Figure 510

1. High Temperature Cable
2. Charge Converter Box
3. Vibration Sensor cable
4. Tachometer Cable
5. Communication Cable
6. Analyzer
7. Speed Unit
8. N2 Extension cable
9. N2 Splitter
10. N2 Sensor
11. Bracket
12. Probe
13. Tachometer cable
14. Adapter
15. Vibration Sensor

C. Vibration Survey (Ref. Fig. 514)

CAUTION: DO NOT EXCEED ANY ENGINE OPERATING LIMIT WHEN TRIM BALANCING (REF. Chapter 05-10-00, OPERATING LIMITS AND LEADING PARTICULARS). IF ANY N1 SETTING WILL CAUSE THE ENGINE TO EXCEED AN OPERATING LIMIT, OMIT THAT SETTING.

(1) Determine engine maximum N1% RPM for local pressure altitude and ambient temperature from the Aircraft Flight Manual.

NOTE: Obtain aircraft and engine information before start of the test. i.e. aircraft registration number, aircraft hours, engine serial number, hours and cycles.

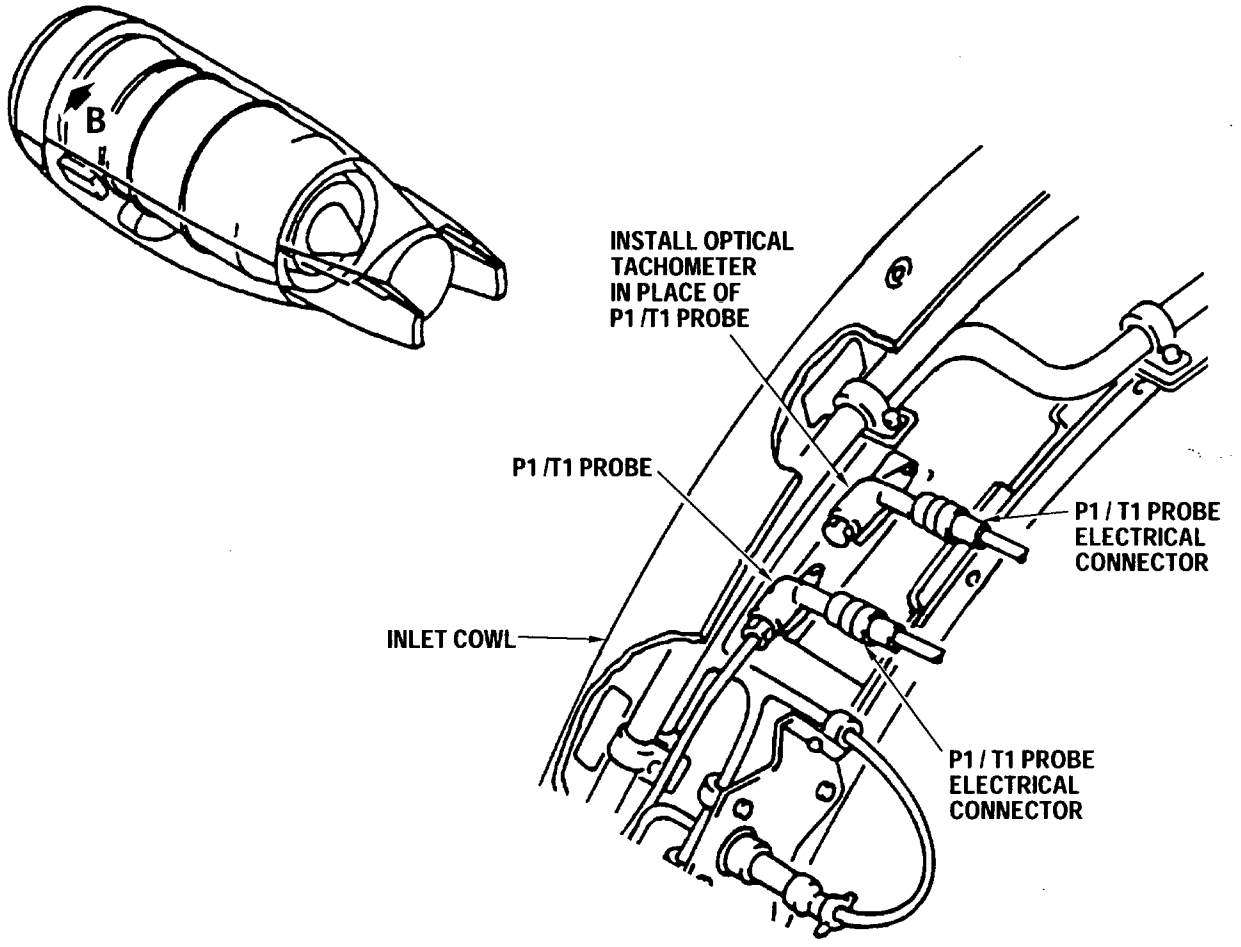
(2) Install the maintenance level Transient Vibration Survey application in the TEC Model 4040 Viper Analyzer. Switch the power on.

NOTE: Make sure the battery charge indication is more than 60%. It is recommended that the analyzer be connected to the aircraft power outlet.

CAUTION: MAKE SURE THE INFORMATION ON THE VIPER ANALYZER SCREEN IS CORRECT BEFORE PRESSING ENTER.

(3) At the "Main" menu, select the Transient Vibration Survey option with the cursor upper/lower cursor keys and press ENTER.

(4) At the "Transient Vibration Survey" menu, select Start Job with the upper/lower cursor keys and press ENTER.


B
INSTALL OPTICAL TACHOMETER IN PLACE OF P1 /T1 PROBE
P1 /T1 PROBE
P1 / T1 PROBE ELECTRICAL CONNECTOR
INLET COWL
P1 / T1 PROBE ELECTRICAL CONNECTOR
VIEW B

C25496

Installation of Optical Tachometer Probe
Figure 511

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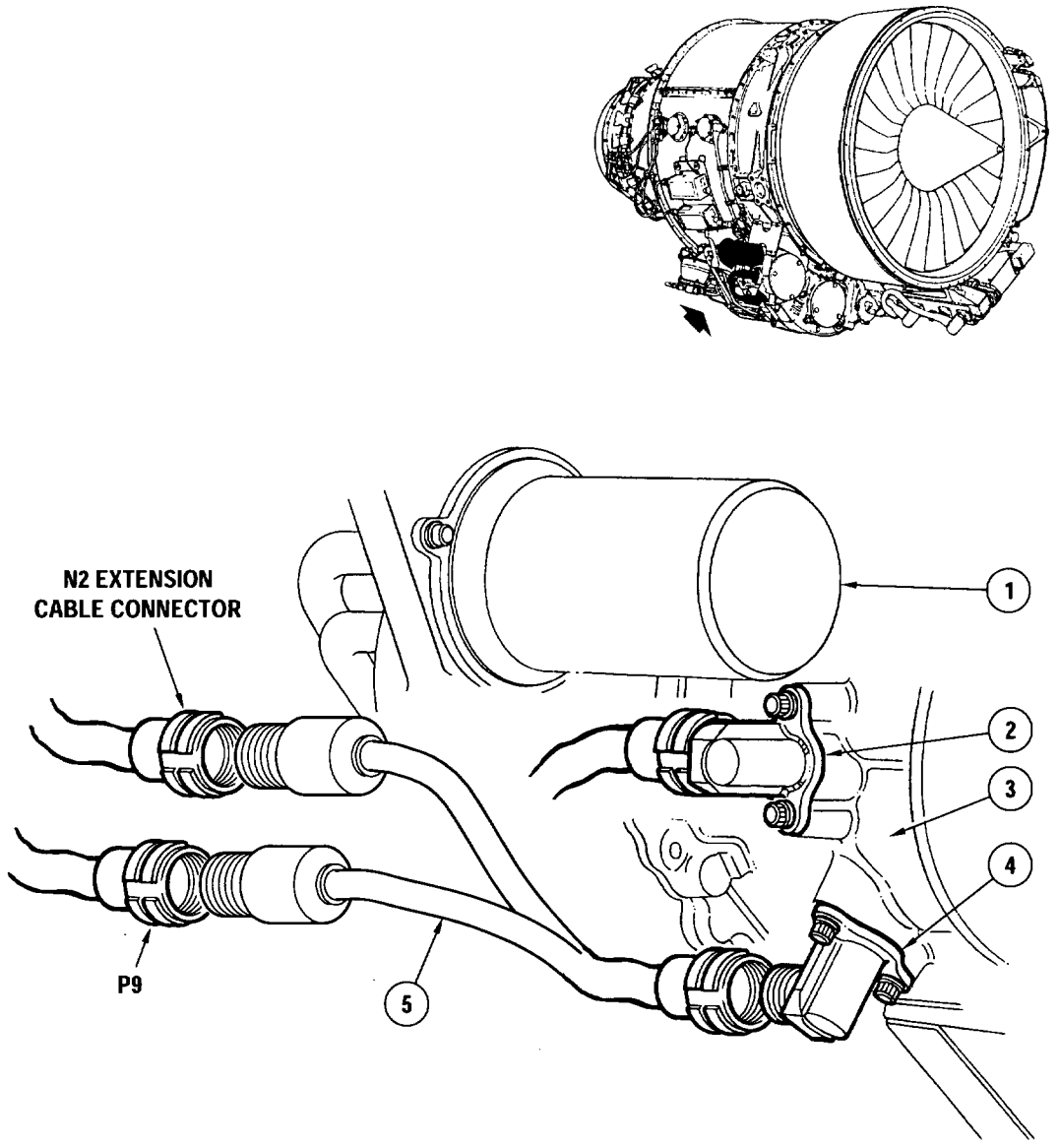
P&WC Proprietary Information. Subject to the restrictions on the title page.



C65513A

Installation of N2 Extension Cable
Figure 512

Key to Figure 512

1. Fuel Filter (Ref.)
2. N2 Speed Sensor (Ref.)
3. Accessory Gearbox (Ref.)
4. N2 Speed Sensor
5. N2 Speed Breakout Splitter

(5) At the "Set-up List" menu, select PW305 with the upper/lower cursor keys and press ENTER.

NOTE: The screen will display "Initializing for Data Acquisition....Please Wait".

(6) At the "Customer Information" menu, type in the name of the Customer and Aircraft Serial number with the keypad and press the cursor down key. You can press the F1 "Names" key to select the name from a list if it has previously been used in this analyzer and press ENTER.

(7) Enter the A/C (Aircraft) Registration number with the keypad and press the down key.

(8) Enter the A/C (Aircraft) Total time in hours with the keypad and press ENTER.

(9) At the "Engine Information" menu, select "POSITION 1" for all tests.

(10) Skip over the first section identified as propeller by pressing the cursor down key until the Engine section is reached.

(11) Enter the engine S/N with the keypad or press the F1 "Serial Nos" key to select it from a list if it has previously been used in the analyzer. Press the down arrow key to move the cursor into the "Type" field, then with the keypad enter the text 305. Press the down arrow key to move the cursor to the "TOS" field and then with the keypad, enter the engine hours since overhaul. Press the down arrow key to move the cursor to the "TSN" field and then with the keypad, enter the engine hours since new. Then press ENTER. There will be a 5-8 second pause while the analyzer initializes the data acquisition application.

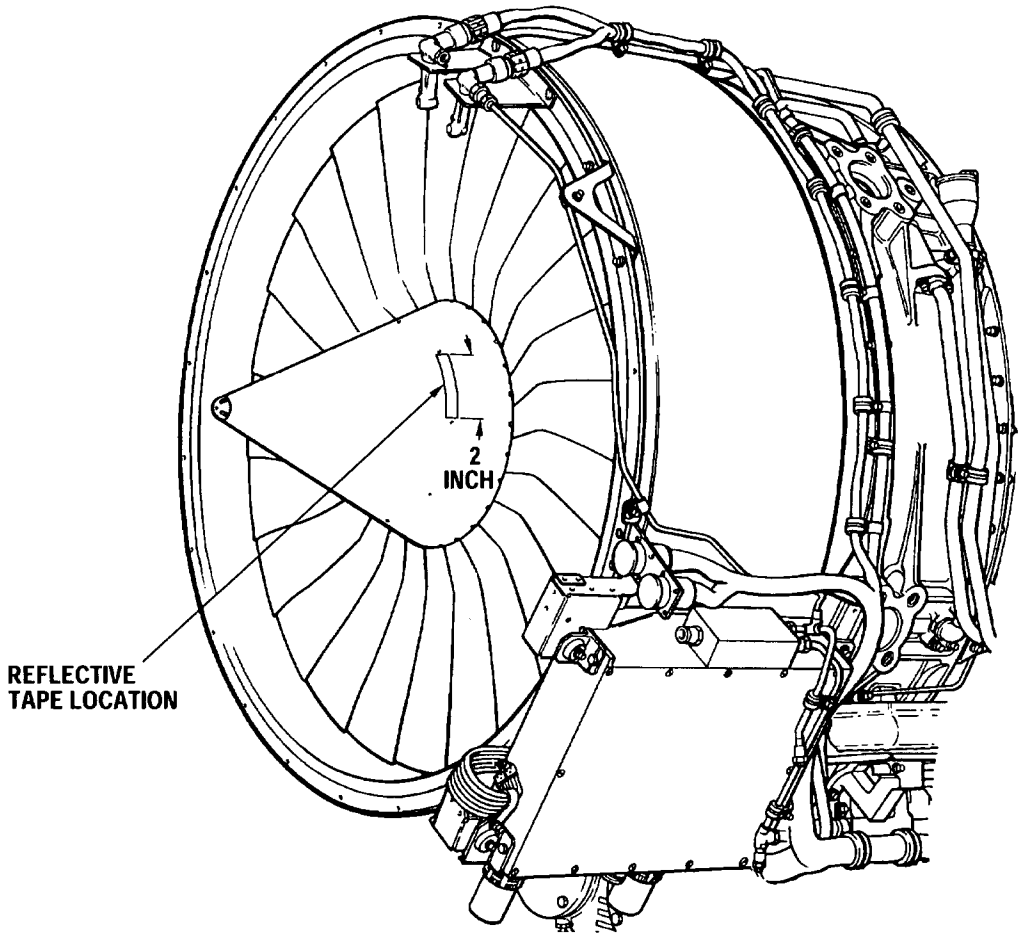
NOTE: The screen will display "Initializing for Data Acquisition....Please Wait".

(12) Start the engine, let engine stabilize and engine oil temperature reach a minimum of 125°F (51°C).

NOTE: If required, run the engine at a higher idle speed to warm the engine oil, then return the power lever to idle.

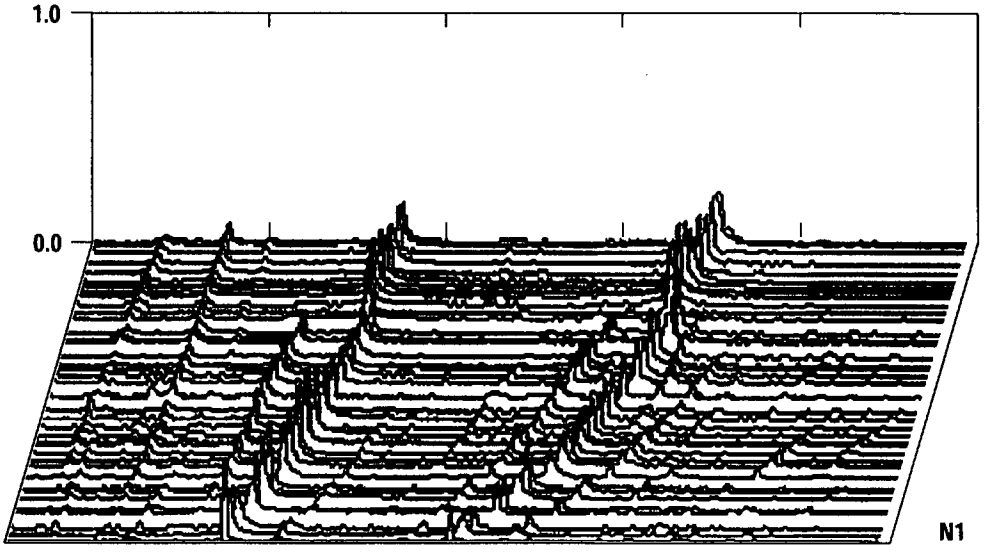
(13) At the start engine menu, press ENTER.

(14) From the "Select Condition" menu, use the down arrow key as necessary to move the cursor to the "[ ] ACCEL" condition and press ENTER.

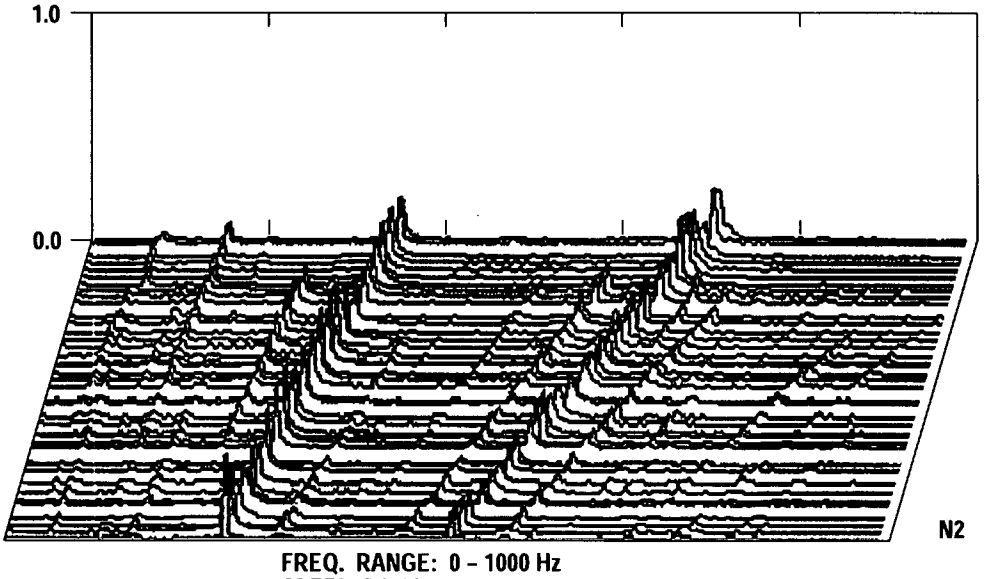


C25497

Installation of Reflective Tape on Nose Cone
Figure 513



FREQ. RANGE: 0 - 1000 Hz
SPEED RANGE: 2474 - 5207 RPM

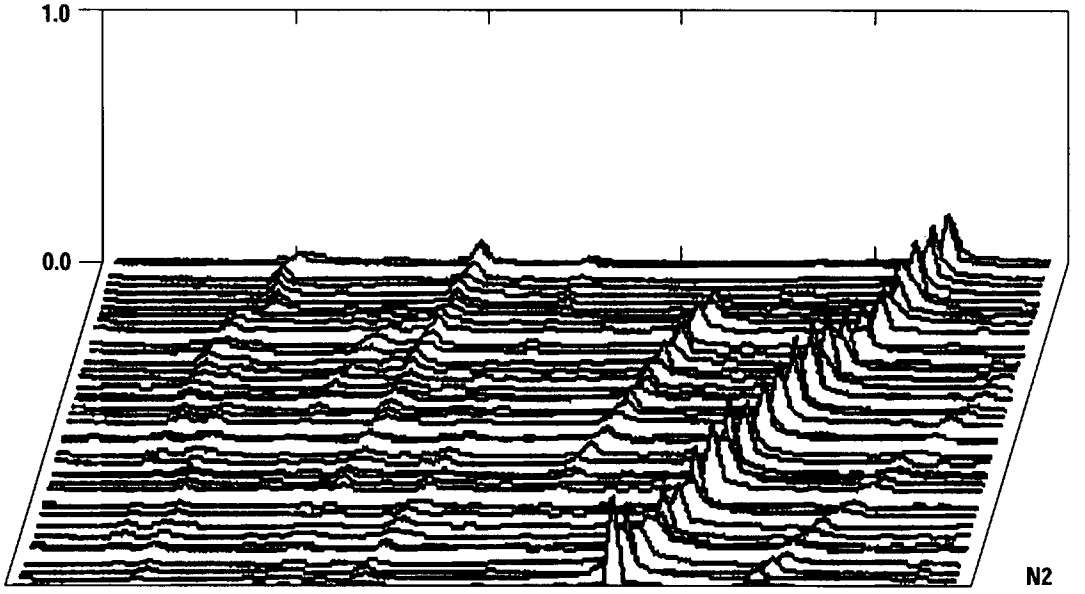


FREQ. RANGE: 0 - 1000 Hz
SPEED RANGE: 15312 - 21367 RPM

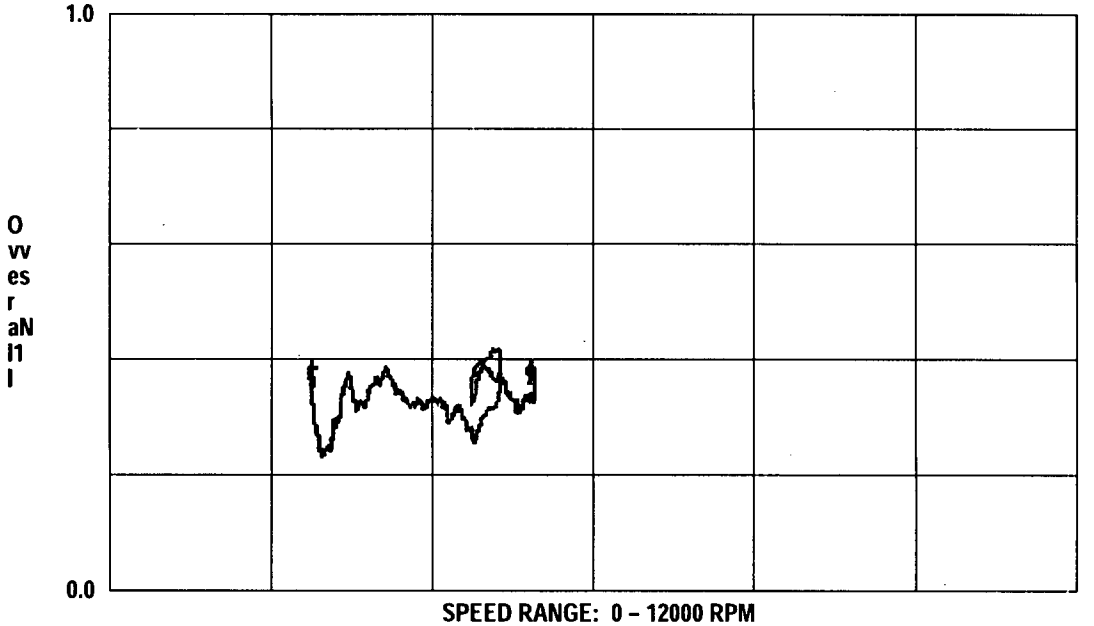
ORIGINAL
As Received By
ATP

C65573

Vibration Survey Graphs
Figure 514 (Sheet 1 of 4)



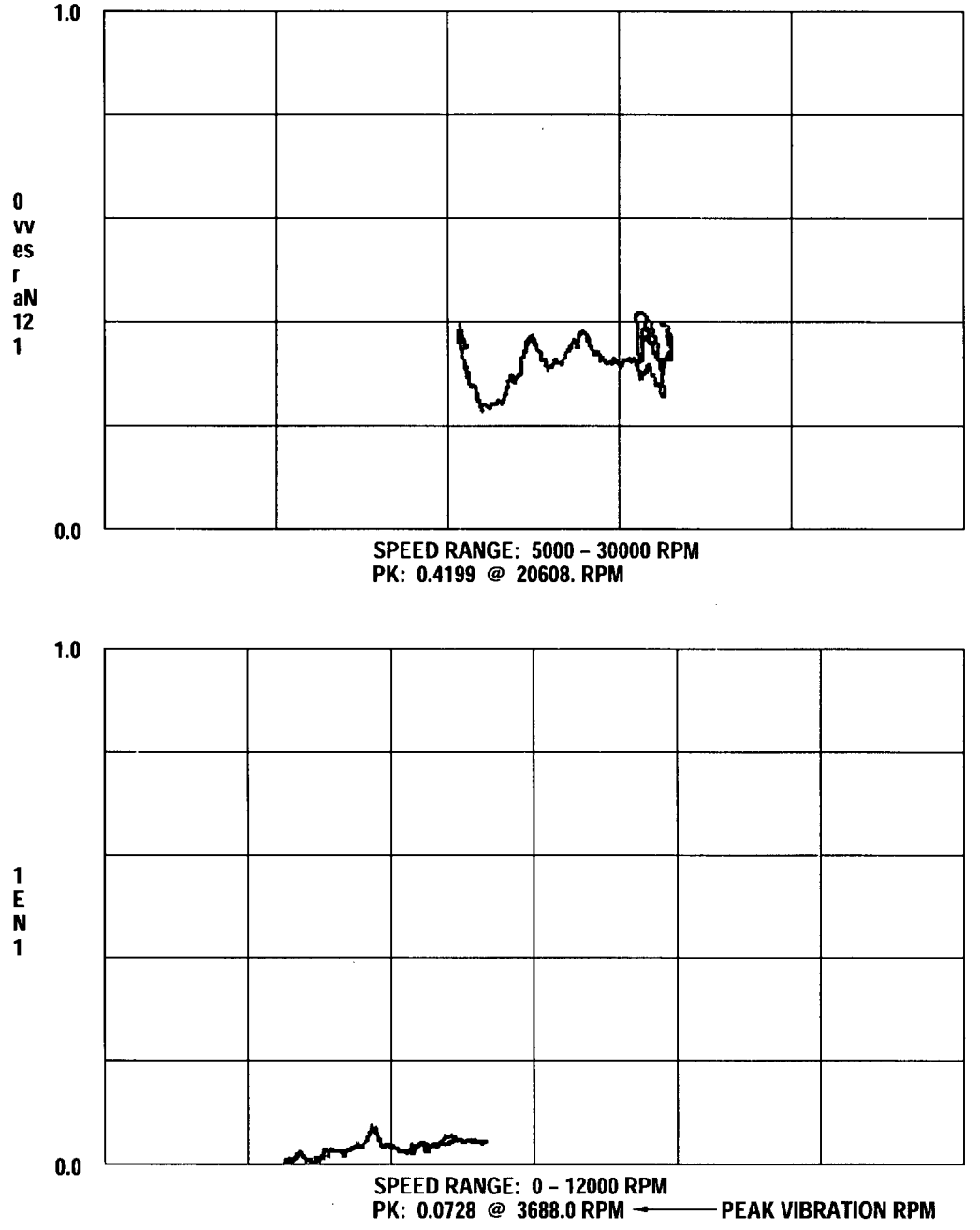
FREQ. RANGE: 0 -400 Hz
SPEED RANGE; 15312 - 21367 RPM



SPEED RANGE: 0 - 12000 RPM
PK: 0.4199 @ 4806.0 RPM

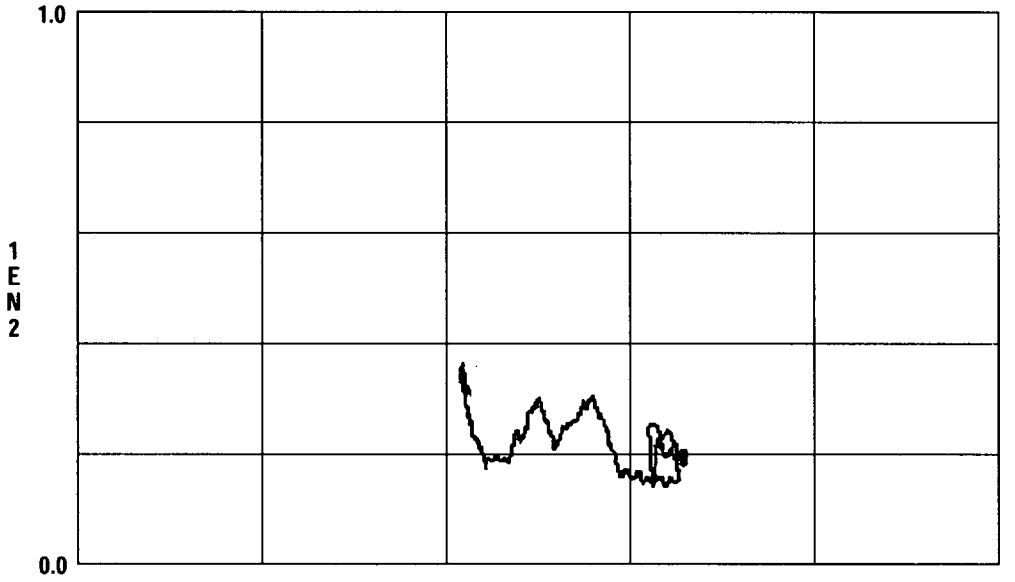
C65574

Vibration Survey Graphs
Figure 514 (Sheet 2)

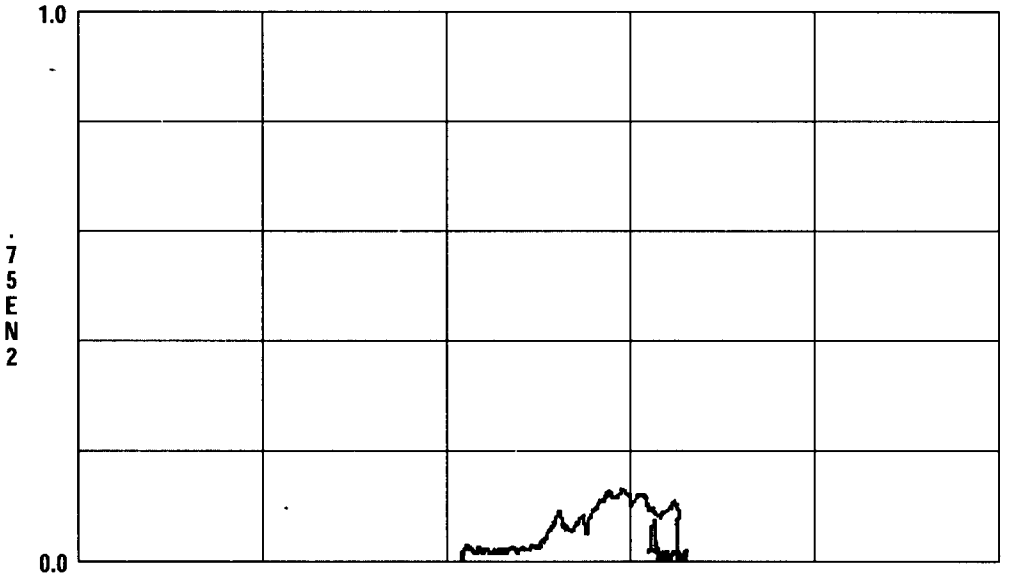


C65575

Vibration Survey Graphs
Figure 514 (Sheet 3)



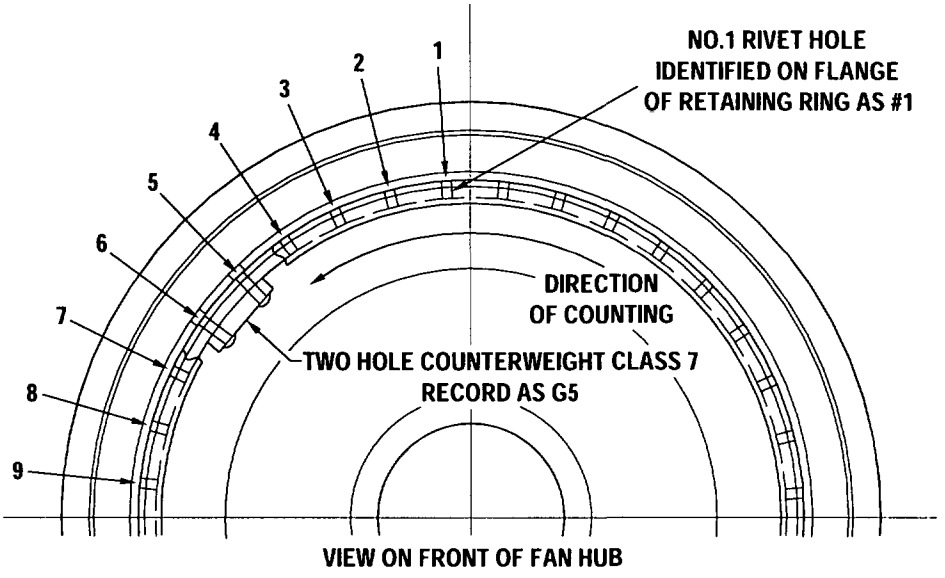
SPEED RANGE: 5000 - 30000 RPM
PK: 0.3613 @ 15312. RPM



SPEED RANGE: 5000 - 30000 RPM
PK: 0.1289 @ 19690. RPM

C65576

Vibration Survey Graphs
Figure 514 (Sheet 4)

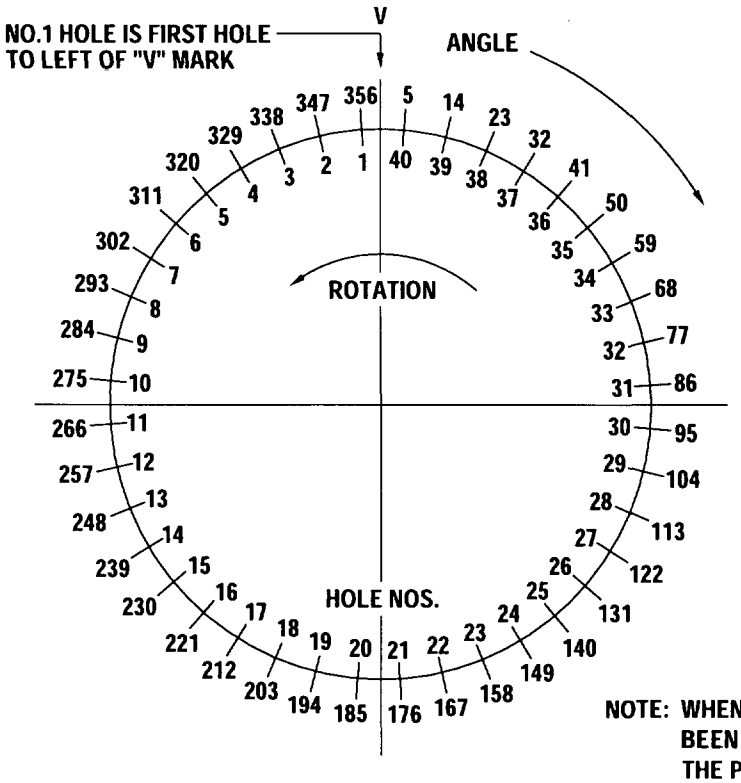


RECORD CWT CLASSES AS FOLLOWS:

CLASS 1 = A (1 HOLE)
CLASS 2 = B (1 HOLE)
CLASS 3 = C (1 HOLE)
CLASS 4 = D (1 HOLE)
CLASS 5 = E (1 HOLE)
CLASS 6 = F (1 HOLE)
CLASS 7 = G (2 HOLES)
CLASS 8 = H (2 HOLES)

C65533

Fan Trim Balancing Data Worksheet
Figure 515 (Sheet 1 of 4)



NOTE: WHEN THE INLET CONE HAS BEEN REMOVED INDICATE THE POSITION OF V-MARK ON THE FAN HUB WITH RESPECT TO THE MARKED FAN BLADE.

30B1864 WEIGHT INCLUDING RIVET CHANGE					
WT. CL.	TRIM CL.	WEIGHT	WT. CL.	TRIM CL.	WEIGHT
1	A	2.01 g	5	E	4.06 g
2	B	2.51 g	6	F	5.18 g
3	C	2.98 g	7	G	7.32 g
4	D	3.52 g	8	H	10.45 g

ENGINE NO. _____

DATE ____/____/____

C61853

Fan Trim Balancing Data Worksheet
Figure 515 (Sheet 2)

REFERENCE RUN (AS IS)

N1 RPM	IN / SEC	DEGREES

TRIAL WEIGHT _____ **GRAMS @** _____ **DEGREES**

TRIAL WEIGHT RUN

N1 RPM	IN / SEC	DEGREES

THEORETICAL TRIM _____ **GRAMS @** _____ **DEGREES**
WEIGHT SOLUTION _____ **GRAMS @** _____ **DEGREES**

ACTUAL CORRECTION _____ **GRAMS @** _____ **DEGREES**
WEIGHTS USED _____ **GRAMS @** _____ **DEGREES**

C25499

Fan Trim Balancing Data Worksheet
Figure 515 (Sheet 3)

BALANCED RUN (OPTIONAL)

N1 RPM	IN / SEC	DEGREES

THEORETICAL TRIM WEIGHT SOLUTION

_____ **GRAMS @** _____ **DEGREES**

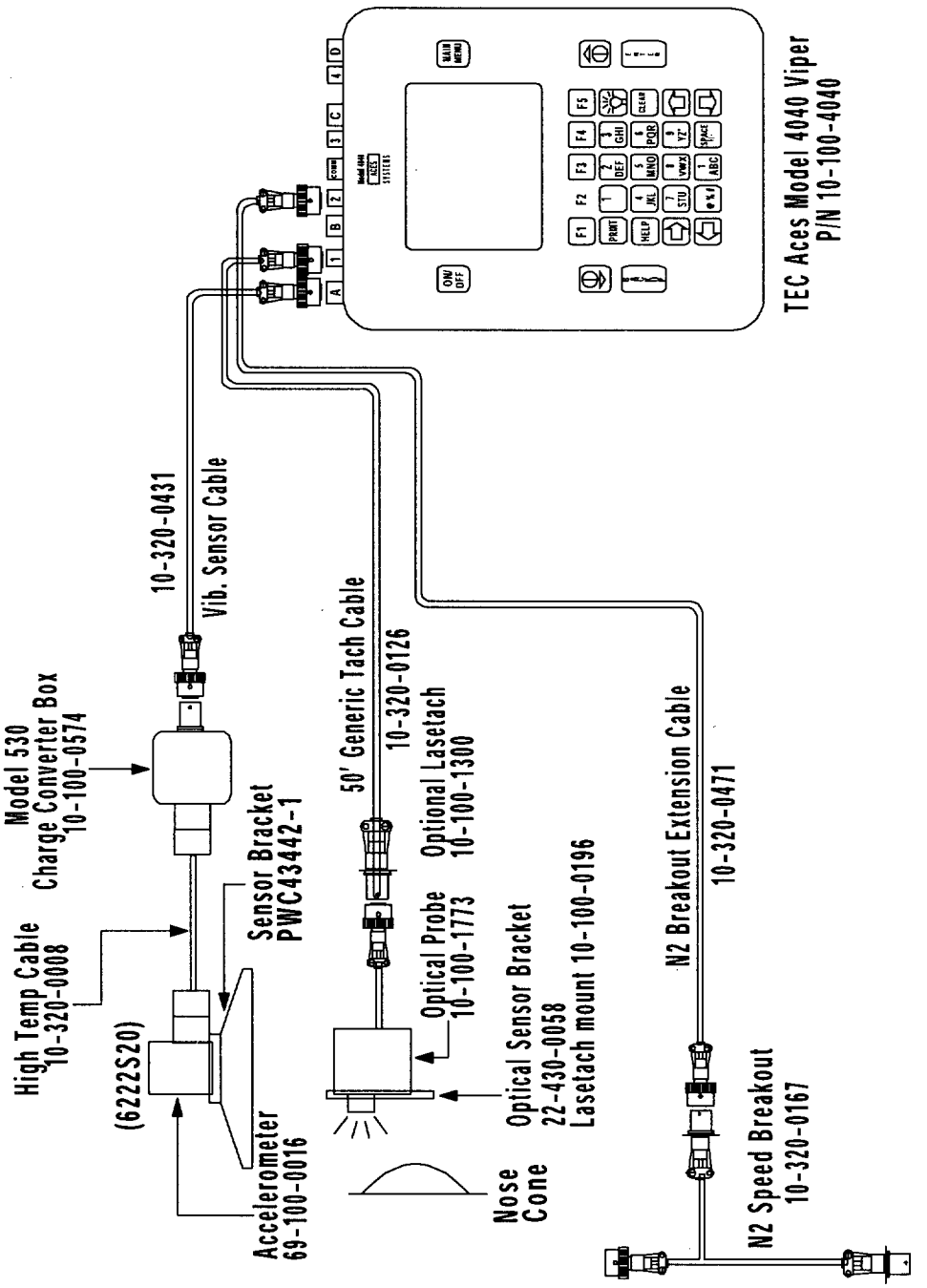
ACTUAL TRIM WEIGHTS USED

_____ **GRAMS @** _____ **DEGREES**

_____ **GRAMS @** _____ **DEGREES**

C25500

Fan Trim Balancing Data Worksheet
Figure 515 (Sheet 4)



Fan Trim Balancing Installation - TEC Model 4040 Viper Analyzer
Figure 516

(15) There will be a 10 second delay while the analyzer prepares the Database manager and recovers database memory. When the real-time display starts, the analyzer will be recording data.

(16) The Viper screen will display the real-time data on the screen, which consists of the following table.

NOTE: Ignore PLANE 3, - Plane 3 is not required for the test. Number of Samples (n) will increment at a rate of 5 samples per second.

TABLE 506, Real-time Data

	Current	Maximum	Units
Plane 1	n.nn	n.nn	IPS
Plane 3	n.nn	n.nn	IPS
N1	nnnnn.nn	nnnnn.nn	IPS
N2	nnnnn.nn	nnnnn.nn	IPS

(17) Accelerate engine from idle to target N2 speed identified in item (1), sweep time approximately 120-180 seconds (between 2 and 3 minutes). When target N2 is achieved, press ENTER to stop data acquisition.

NOTE: 1. Record Max N1, N2 and ITT values.

NOTE: 2. If N2 target is exceeded by more than 1.5% notify PWC field representative.

(18) The Viper analyzer will display the message "Store the Data?". Press the F1 key to answer Yes and save the data, or F5 to answer No if the run is to be deleted.

(19) Decelerate the engine to idle.

(20) Press the F1 key to answer yes to "Store the data?".

(21) Press F1 again to "End Run" to complete the survey.

NOTE: The TEC Model 4040 Viper Analyzer screen will display "Survey Is Complete. Perform Normal Shutdown Sequence".

(22) Press F5 to continue.

(23) Select the "Manage Job" menu with the upper/lower cursor keys and press ENTER.

(24) Select "Review" with the upper/lower cursor keys and press ENTER. The screen will display the surveys that are available. Locate the correct survey with the upper/lower cursor keys and press ENTER.

NOTE: The screen will display the jobs that are available.

(25) Locate the "Customer Name and Aircraft Serial Number" survey with the upper/lower cursor keys and press ENTER.

(26) At the "Select Item To Review" menu, select View 1EN1 vs N1 Vibration with the upper/lower cursor keys and press ENTER. The screen will display the fan vibration plot (Ref. Fig. 514). The plot indicates the peak level at the corresponding N1 speed.

(27) Record the peak amplitude RPM value (e.g.: Peak = 0.13@5574.8).

(28) Shut down the engine.

(29) View all the plots from the menu. Print the plots by selecting Print All. For print set-up, connect printer ZTHERMAL PRINTER to COMM port with Print cable 10-320-0157.

(30) Return to "Main" menu.

D. Initial Fan Balance Run

(1) Remove the inlet cone (Ref. 72-30-01).

(2) Record the location of the counterweights on the front balancing rim in the Fan Trim Balancing Data Worksheet (Ref. Fig. 515).

(3) Install the inlet cone (Ref. 72-30-01).

(4) Power on the Viper analyzer.

(5) At the "Operation Options" menu, select applicable engine family "PW300", select applicable engine model and application of high speed trim "PW305 Fan" and press enter.

CAUTION: MAKE SURE THE INFORMATION ON THE VIPER ANALYZER SCREEN IS CORRECT BEFORE PRESSING ENTER

(6) At the Main menu, select "Balance Fan" with the upper/lower cursor keys and press ENTER.

(7) Select "Start Job" with the upper/lower cursor keys and press ENTER.

(8) At the "Set-up List", select PW305 with the upper/lower cursor keys and press ENTER.

(9) At the "Customer Information" menu, type in Customer Name and Aircraft Serial Number, press ENTER.

NOTE: The screen will display "Initializing for Data Acquisition....Please Wait".

(10) At the "Engine Information" menu, select "POSITION 1", then use the upper/lower curser keys to move to "ENGINE".

(11) Input the A/C Registration with the keypad keys.

(12) At the "Engine S/N" menu, input "CCXXXX" and press ENTER.

NOTE: The screen will display "Initializing for Data Acquisition....Please Wait".

(13) Input the A/C Total Time with the keypad keys and press ENTER.

(14) At the Fan Balance Speed menu, set the balance speed to 5800 RPM (nominal) with the keypad. The five N1 speeds to be used are:

SPEED 1 = 5300 RPM = (NOMINAL -500 RPM)
SPEED 2 = 5530 RPM = (NOMINAL -250 RPM)
SPEED 3 = 5800 RPM = (NOMINAL)
SPEED 4 = 6050 RPM = (NOMINAL +250 RPM)
SPEED 5 = 6300 RPM = (NOMINAL +500 RPM)

NOTE: The VIPER Analyzer will calculate percentage. The next screen will confirm RPM and percentage.

(15) At the Label Detail Weight Holes menu, input the location of the detail balance weights. Use the left/right cursor keys to select the hole numbers and change the selected hole(s) to an "X" with the cursor keys. When done, press ENTER.

(16) Start the engine. Let the engine stabilize and oil temperature reach 125°F (51°C) minimum. Press ENTER.

NOTE: The VIPER Analyzer will prompt Fan/Turbine Balance Setup as a reminder to verify unit connections. Press ENTER to continue.

(17) The VIPER Analyzer will display CURRENT RPM VALUE. Press ENTER.

CAUTION: DO NOT EXCEED ENGINE OPERATING LIMITS (REF. Chapter 05-10-00, OPERATING LIMITS AND LEADING PARTICULARS). MAINTENANCE MANUAL ENGINE OPERATING LIMITS SUPERSEDE ANY INSTRUCTIONS IN THE VIPER ANALYZER PROCEDURE.

(18) The VIPER Analyzer will display the peak vibration N1 speed minus 500. Bring the engine to this speed and press ENTER. At the next display, allow 10 to 15 seconds for the phase and amplitude to stabilize, then press ENTER to accept the measuring point. Repeat the procedure for the following N1 rpm settings.

SPEED 1 = 5300 RPM = (NOMINAL -500 RPM)
SPEED 2 = 5530 RPM = (NOMINAL -250 RPM)
SPEED 3 = 5800 RPM = (NOMINAL)
SPEED 4 = 6050 RPM = (NOMINAL +250 RPM)
SPEED 5 = 6300 RPM = (NOMINAL +500 RPM)

(19) Return the engine to idle speed.

(20) At the "Review Trial Run Data" menu, review data taken and press ENTER.

(21) Shut down the engine and wait as necessary for the optimization of weights to be completed. Press F5 to continue.

(22) Record the position of the counterweight and hole defined by the VIPER Analyzer.

E. Trial Weight Trim Balance Run

(1) Review the trim balance mass and location solution defined by Viper analyzer.

NOTE: Trim balance counterweight rivet hole locations are counted counterclockwise from the inlet cone index 'V' mark.

(2) Install trial counterweight as follows:

(a) Remove inlet cone (Ref. 72-30-01).

(b) Record the class and location of the existing counterweights on the fan front balancing rim. This information is required if the solution counterweight location given by the analyzer is occupied by an existing counterweight, and a split weight option is required.

NOTE: The trim balance counterweight mass and position defined by the Viper analyzer is called the solution.

(c) Install class of counterweight closest to trial solution defined by analyzer at indicated fan balance location (Ref. Para. 13. - Rivet and Counterweight). Do not install a trial weight heavier than required. Classes are listed in the Table below:

Class	Ref. Weight Including Rivet (grams)
CL1	2.18
CL2	2.68
CL3	3.16
CL4	3.63
CL5	4.21
CL6	5.36

(d) After the trial counterweight has been installed, press ENTER to continue.

(e) At the FAN INSTALLED WEIGHTS menu, press ENTER if the trial counterweight is installed in the positions defined by the analyzer .

(f) If the trim counterweight is installed in a hole other than the defined hole, change the class and location on the Viper analyzer with the cursor keys. Record this information.

(g) The Viper analyzer will review the solution and ask for confirmation. If satisfactory, answer NO to the question "RE-ENTER WEIGHTS?"

(h) Install the inlet cone (Ref. 72-30-01).

(3) Perform a trial counterweight run as follows:

(a) Start the engine. Let the engine stabilize and oil temperature reach 51°C (125°F) minimum.

(b) Repeat the fan balance run and check the new vibration level. The Viper analyzer will provide the solution counterweight and angle.

NOTE: The analyzer calculates final or successive solutions based on previous trial trim weight having been removed.

(c) Return the engine to idle speed.

(d) Shut down the engine.

(4) If vibration level is within acceptable limits, end the balancing procedure.

(5) If vibration level is not acceptable, record the new counterweight size and location calculated by analyzer.

(6) Remove first trial weight and install solution counterweight (Ref. Para. 13. - Rivet and Counterweight):

NOTE: 1. The analyzer calculates final or successive solutions based on previous trial counterweight having been removed.

NOTE: 2. Unbalance is corrected by using a maximum of four counterweights, including those used for detail balancing. Counterweights may be added or existing fan detail counterweights may be replaced

(7) When engine vibration is within acceptable limits, record the counterweight(s) mass and position(s), with respect to fan hub V-mark, in the engine log book.

(8) Remove the test equipment and return the engine to normal operating condition.

13. Rivet and Counterweight - Front Hub

A. Removal of Rivet and Counterweight (Ref. Fig. 517)

(1) Remove the inlet cone (Ref. 72-30-01).

(2) Find the counterweight (6) and rivet (5) to be removed from balancing result.

CAUTION: DO NOT DAMAGE FAN BALANCING ASSEMBLY WHEN REMOVING RIVETS.

(3) Remove rivet (5) and counterweight (6) using suitable chisel (PWC66645) and punch (PWC60614). Remove the flared end of the rivet with the chisel.

(4) Check the hub (2) areas for metal particles and clean as necessary with alcohol (PWC11-014) and dry.

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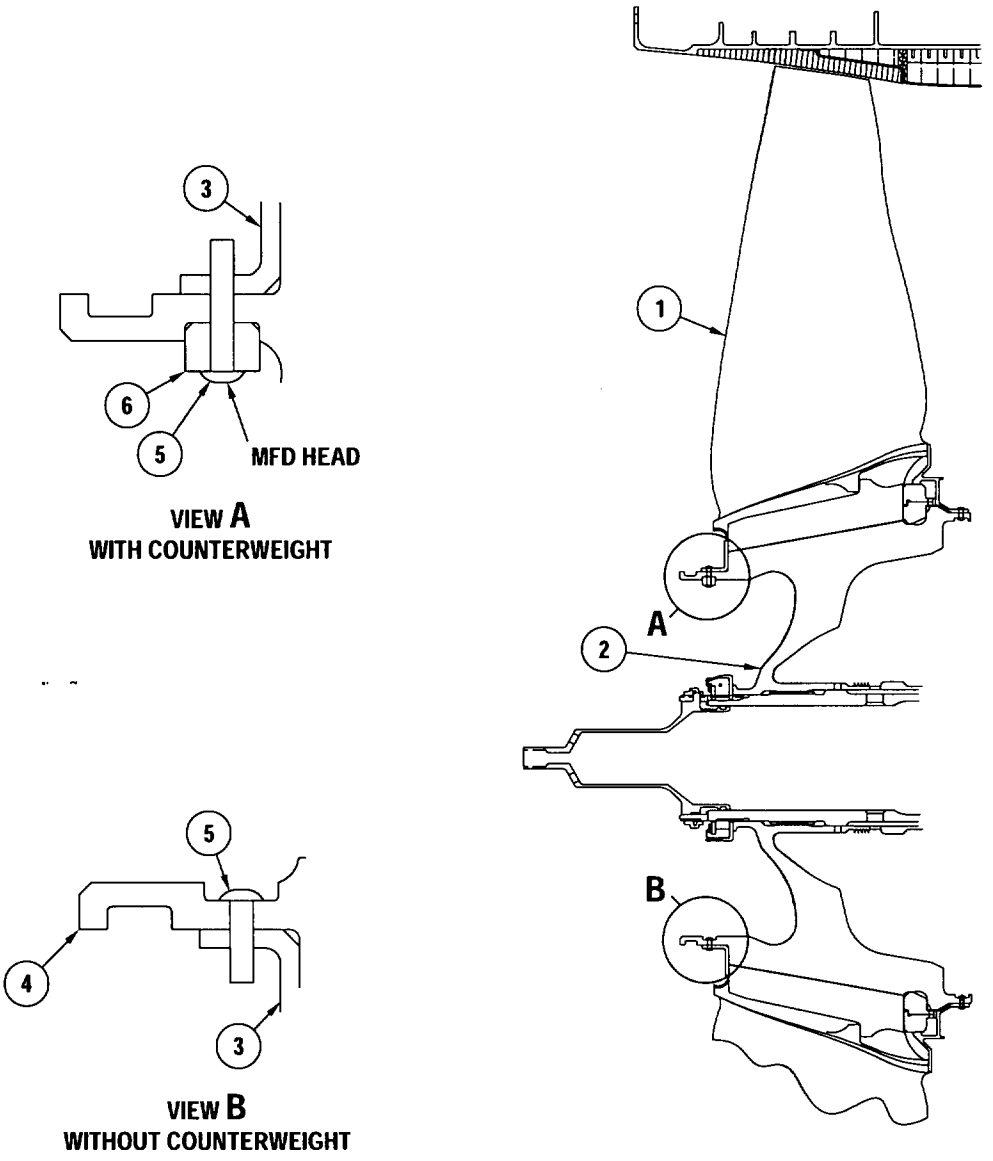
P&WC Proprietary Information. Subject to the restrictions on the title page.



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Removal of Rivet and Counterweight
Figure 517

Key to Figure 517

1. Fan Blade (Ref.)
2. Hub
3. Retaining Ring
4. Balance Rim (Part of Hub)
5. Rivet
6. Counterweight

B. Installation of Rivet and Counterweight (Ref. Fig. 517)

(1) Find the location of the counterweight (6) and rivet (5) in the balance rim (4) as specified from the balancing result.

CAUTION: FOR HUB WITH FRONT RETAINING RING, ALL RIVETS (MANUFACTURED HEADS) TO BE POSITIONED ON THE INSIDE DIAMETER OF THE HUB.

(2) Install and flare the rivets (5) without the counterweights (6) with riveter (PWC43238) and rivet set (PWC43239) and (PWC43240).

(3) Install the and flare the rivets (5) with counterweights (6) with riveter (PWC43238) and rivet set (PWC60085) and (PWC43240).

POWER PLANT - CLEANING

1. General

   A. Engine cleaning is basically confined to compressor desalination or performance recovery washes. However, an external wash is recommended whenever the engine is contaminated with salt. Refer to Chapter 05-20-00 for wash schedule.

   B. To perform a compressor wash, the engine is motored using the starter and wash fluids are sprayed through the fan at a high flow (10 gal/min, 37.8 liters/min) using a suitable spray wand with a nozzle angled to ensure cleaning fluid enters the engine core.

   C. Motoring washes are carried out at an N2 of 8 to 25% and the water or cleaning mixture, which is pressurized at 60 psi (414 kPa) is sprayed into the compressor inlet via the high flow wash nozzle. Washing while motoring the engine ensures that the cleaning mixture remains in liquid form.

   D. To perform a turbine wash the engine is dry motored and wash fluid is sprayed through a nozzle installed in one of the igniters mount openings.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC05-005	Emulsifier
PWC05-089	Lockwire
PWC11-001	Cleaner, Engine Internal
PWC11-003	Cleaner, Engine Internal - Biodegradable
PWC11-010	Alcohol, Methyl
PWC11-027	Solvent
PWC11-066	Cleaner, Engine Internal - Biodegradable

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC32677-300	Engine Wash Rig
PWC60708	Nozzle, Turbine Wash
PWC61152	Nozzle, Compressor Wash

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Engine External Wash

A. Procedure

CAUTION: DO NOT USE GASOLINE OR SIMILAR TOXIC SUBSTANCES FOR EXTERNAL ENGINE CLEANING. DO NOT ATTEMPT TO WASH AN ENGINE THAT IS STILL HOT OR RUNNING. ALLOW ENGINE TO COOL FOR A MINIMUM PERIOD OF 40 MINUTES AFTER SHUTDOWN TO PREVENT PRECIPITATION FROM INADVERTENT USE OF HARD WATER.

(1) Fresh water external washing is recommended when engine is contaminated with salt, volcanic dust or corrosive chemicals such as those found in industrial smog. Demineralized water is not necessary. The engine should never be left in a contaminated condition overnight, or longer.

(2) If water wash is ineffective, a petroleum solvent (PWC11-027) /water emulsion may be used to remove oil, grime, or other materials/fluids (e.g. Hydraulic fluids). Thoroughly rinse with water to remove all traces of cleaning fluid. Completely dry the engine using clean, dry compressed air.

NOTE: External cleaning is very effective in tracing possible origin of external oil leakage.

6. Internal Washing

A. General

(1) Washing removes salt, dirt and other baked-on deposits that accumulate in the gas path and cause engine performance deterioration.

(2) A compressor/turbine desalination wash uses water or water/methanol (PWC11-010) (Ref. Table 701 or Fig. 701) to remove salt and light deposits. The addition of cleaning agents is not recommended.

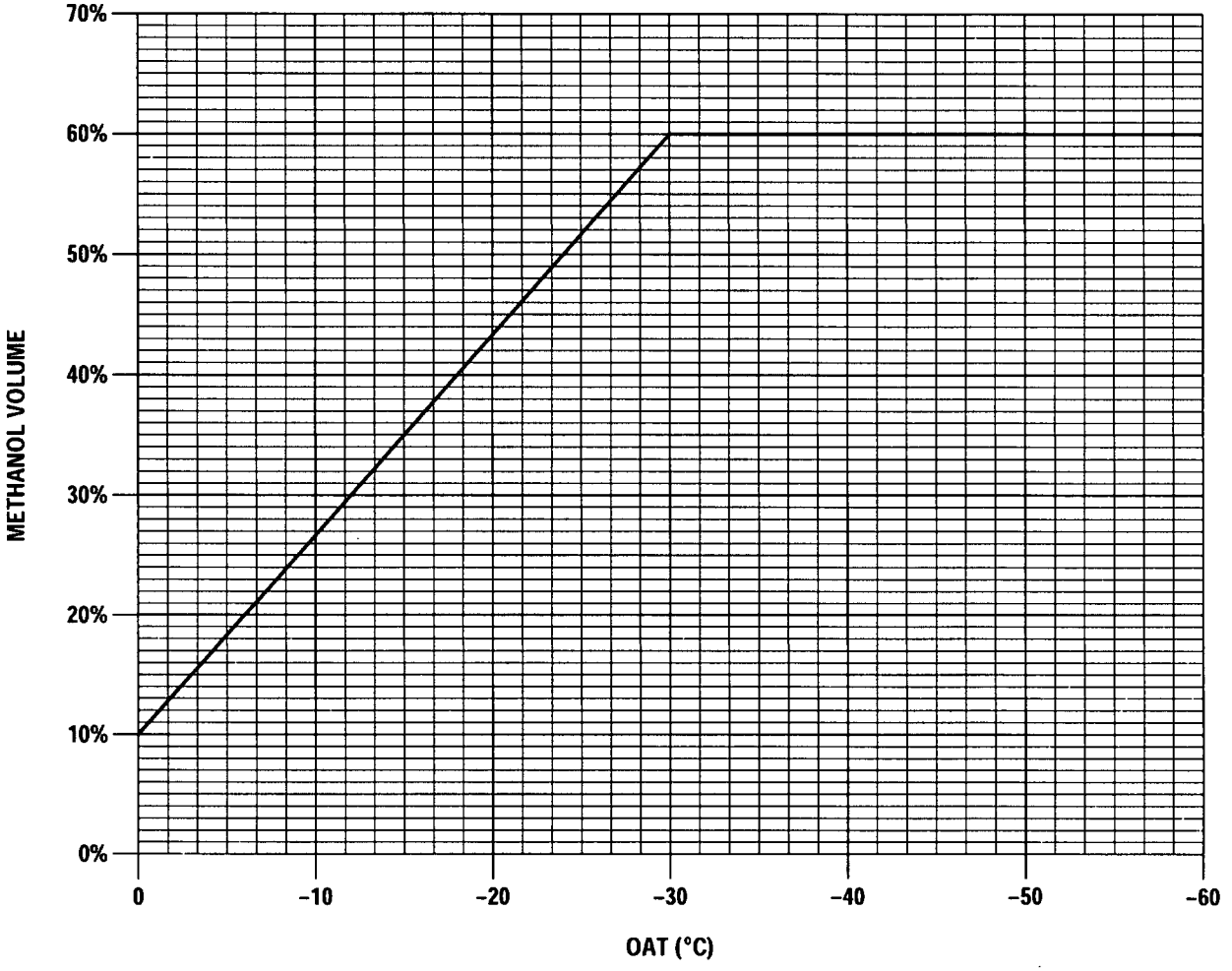
NOTE: Figure 701 introduces an alternate method to determine the methanol requirement when mixing a desalination/rinse solution for use at temperatures below 0°C (32°F).

(3) A rinse wash uses the same solution (according to temperature) as the desalination wash (Ref. Table 701) and is used after a performance recovery wash to clean the gas path.

(4) A performance recovery wash uses cleaning agents (Ref. Tables 702, 703, 704 and 705) in the wash solution to remove deposits that cannot be dissolved by a desalination wash.

(5) The formula of the P&WC developed performance recovery solution WCT is shown in Table 704.

(6) Depending upon the operating environment, the nature and frequency of washing are recommended to be in accordance with Chapter 05-20-00.



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Desalination/Rinse Solution - Determining Methanol Requirement at Temperatures Below 32°F (0°C)
Figure 701

TABLE 701, Desalination/Rinse Solutions

Ambient Temperature		Water	Methanol
°F	°C	% by Vol.	% by Vol.
+36 up	+2	100	Nil
-13 to +36	-25 to +2	50	50
Below -13	Below -25	40	60

B. Preparation of Equipment (Ref. Figs. 702 and 703)

NOTE: 1. Two tooling set-ups are approved for compressor desalination or performance recovery wash.
One set-up uses the compressor wash nozzle assembly (PWC61152) to immobilize the fan and inject the fluids.
The other uses fan wedges (PWC66581) to immobilize the fan, and a locally designed and fabricated spray nozzle or wand (henceforth called a "Wash Wand") to inject the fluids.

NOTE: 2. The "Wash Wand" must be designed and fabricated to deliver the recommended amount of fluid (19 liters or 5 US gallons), at the recommended pressure (50 psi or 345 kPa), in the recommended time (25 to 30 seconds) to the core of the engine.

WARNING: OPERATING PERSONNEL SHOULD WEAR ADEQUATE CLOTHING TO PREVENT WASH FLUID TO CONTACT SKIN. OPERATING PERSONNEL SHOULD ALSO WEAR PROTECTIVE EQUIPMENT FOR EYES AND FACE SUCH AS GOGGLES, MASKS OR FACE SHIELD.

WARNING: FOR CLEANING AGENTS, REFER TO MANUFACTURER'S MATERIAL SAFETY DATA SHEET FOR INFORMATION REGARIDING SAFE HANDLING, USE AND CONTROL MEASURES.

CAUTION: THE "WASH WAND" SHOULD ALSO BE DESIGNED TO DIRECT THE FLUID STREAM INTO THE CORE OF THE ENGINE WHILE KEEPING OPERATING PERSONNEL AT A SAFE DISTANCE FROM ANY ROTATING PARTS OR SPLASH BACK, AND SHOULD NOT PRESENT ANY RISK OF COMING INTO CONTACT WITH ROTATING PARTS, OR OF PARTS LIBERATING AND BEING INGESTED BY THE ENGINE. REFER TO THE AIRCRAFT MAINTENANCE MANUAL FOR THE SAFETY AND HANDLING PRECAUTIONS RELATIVE TO THE AIRCRAFT.

(1) Set up compressor wash rig as shown on schematic (Ref. Fig. 703).

WARNING: LET A HOT ENGINE COOL FOR 30 MINUTES MINIMUM BEFORE DOING A COMPRESSOR WASH.

(2) If compressor wash nozzle assembly (6) is used, proceed as follows to install the compressor wash nozzle assembly into the engine inlet:

(a) Remove one P1/TI probe from the intake case mounting holes and cover the other probe with suitable waterproof protectors to avoid the ingestion of water in the probes.

(b) Push the compressor wash nozzle (6) until the three pads (3) touch into the inlet cone.

(c) Extend locking rod (1) through the hole vacated by the removal of the P1/T1 probe.

(d) Make sure the flat face of each of the four spray nozzles is tangent to the fan hub and target spray into the core of the engine.

(e) Extend the support rods (4) while keeping the support pads (3) in contact with the inlet cone. Hand tight the rods.

(f) Extend and secure the fan lock rod (2) to touch one of the fan blade leading edge and hold the fan assembly from rotating during the motoring cycle.

(g) Make sure the compressor wash rig is securely installed in the inlet case.

(h) Connect the wash rig hose.

(3) If alternative Compressor Wash method using Wash Wand, proceed as follows:

(a) Install four fan wedges (PWC66581) to prevent fan rotation.

(b) Position the four fan wedges securely between the fan blade tips and the fan case to prevent the normal rotation of the fan. Take care in installing the wedges to avoid damage to the abradable liner.

(c) Connect the wash rig hose to the "Wash Wand".

C. Preparation of Cleaning Solutions

(1) Prepare a 5 US Gal. or (10 US Gal. in case of performance recovery) of desalination/rinse solution based on the Outside Air temparature (OAT) of the day in accordance to Table 701. Use either demineralized water or drinking water quality specified below.

(2) Get a supply of demineralized water complying with the following criteria:

(a) Appearance: Free of suspended solids.

(b) Total solids: 10 ppm (mg/1) maximum.

(c) Specific conductance: 11 Microohms/cm maximum.

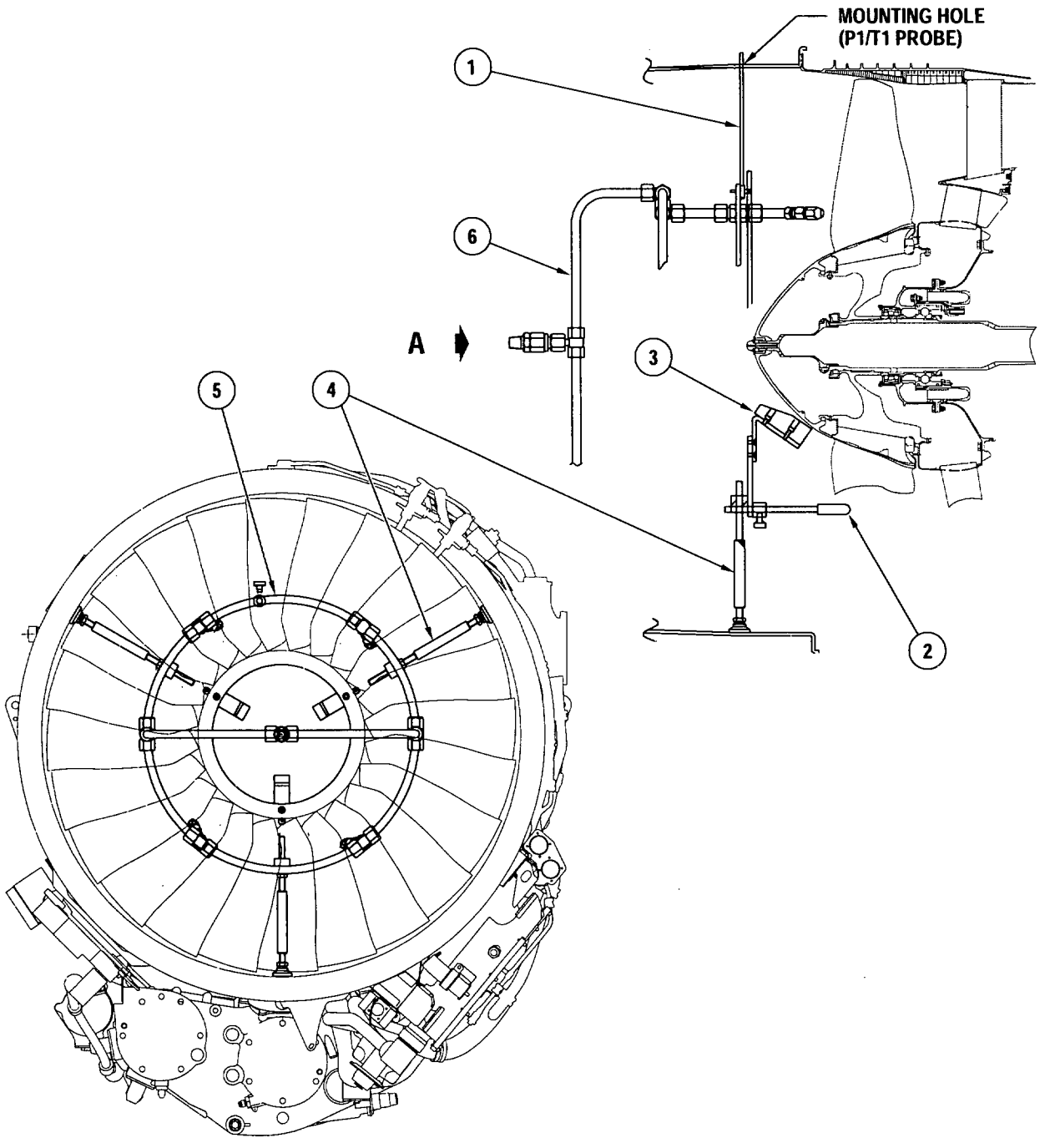
(d) Silica content: 3 ppm (mg/1) maximum.

(e) Ph: 5.0 + 7.5 inclusive.

NOTE: Intake filter must not be coarser than 10-microns.

(3) Get a supply of drinking quality water complying with the following criteria:

(a) Appearance: free of suspended solids.



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Preparation of Equipment
Figure 702

Key to Figure 702

1. Locking Rod (Part of item 6)
2. Fan Lock Rod (Part of item 6)
3. Nose Cone Pad (Part of item 6)
4. Support Rod (Part of item 6)
5. Wash Fixture Manifold (Part of item 6)
6. Compressor Wash Nozzle Assy.(PWC61152)

(b) Total solids: 175 ppm (mg/1) maximum.

(c) Ph: 6.0 to 8.0 inclusive.

(d) Chlorides: 15 ppm (mg/1) maximum.

(e) Sulphates: 10 ppm (mg/1) maximum.

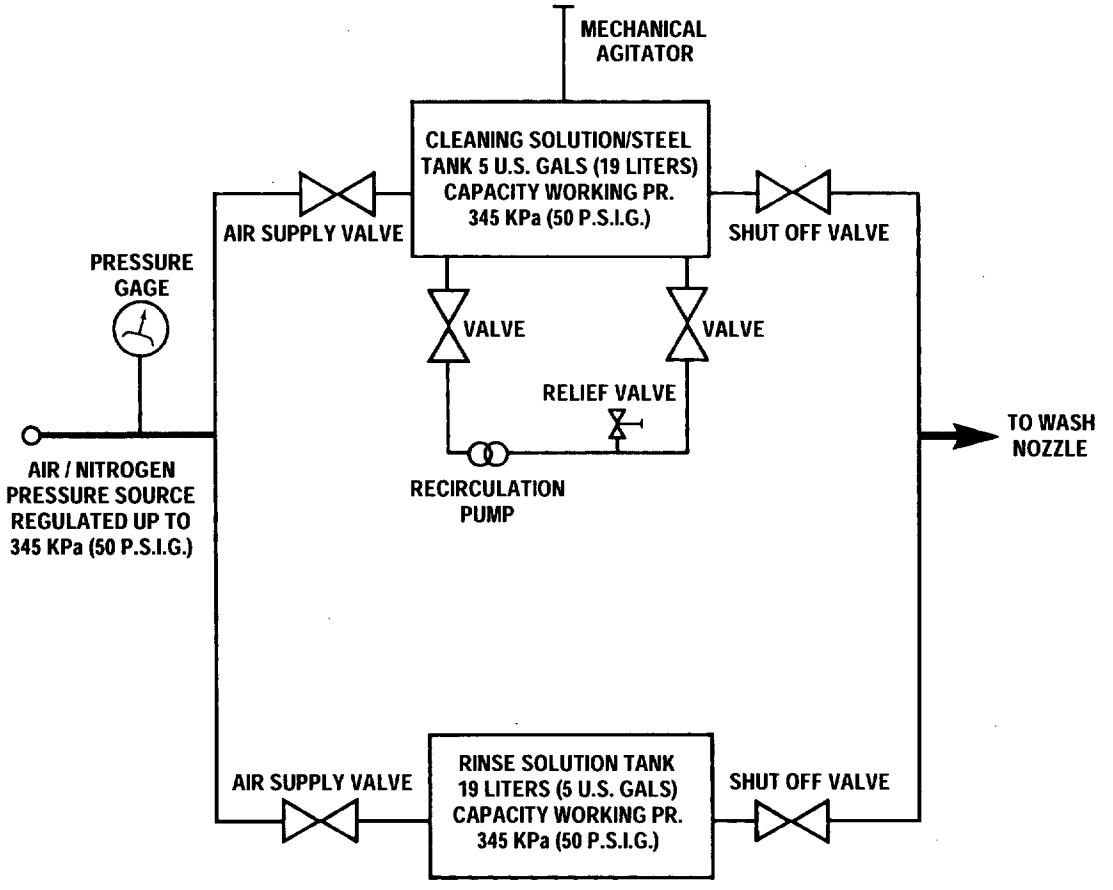
(4) Depending on the prevailing outside air temperature (OAT), prepare a 5 US Gal. of performance recovery solution as per Tables 702, 703, 704 and 705 using one of the following cleaning agents:

TABLE 702, Desalination/Performance Recovery Solutions

Ambient Temperature		Cleaning Agent	Engine Fuel	Methanol	Water
°F	°C	% by Vol.	% by Vol.	% by Vol.	% by Vol.
+36	+2 up	25	Nil	Nil	75
-13 to +36	-25 to +2	25	15	20	40
Below -13	Below -25	25	15	40	20
EXAMPLE:	Typical mixture proportions using B & B 3100 at ambient temperature of -13 to +36°F (-25 to + 2°C).				
	B & B 3100 25% by Vol = 1250 ml in 5 liters (1.33 US gal.)				
	Fuel 15% by Vol = 750 ml				
	Methanol 20% by Vol = 1000 ml				
	Water 40% by Vol = 2000 ml				
	Total 100% by Vol = 5000 ml or 5 liters (1.33 US gal.)				
CAUTION: ADD 150 ml OF WITCONATE EMULSIFYING AGENT (PWC05-005) AND MIX SOLUTION THOROUGHLY BEFORE USE TO PREVENT FUEL SEPARATION.					

NOTE: Approved solutions for Table 702 are:

- CLIX (PWC11-001)
- Almon AL-333 (PWC11-001A)
- Magnus 1214 (PWC11-001B)


MECHANICAL AGITATOR
CLEANING SOLUTION/STEEL TANK 5 U.S. GALS (19 LITERS) CAPACITY WORKING PR. 345 KPa (50 P.S.I.G.)
AIR SUPPLY VALVE
SHUT OFF VALVE
PRESSURE GAGE
VALVE
VALVE
RELIEF VALVE
TO WASH NOZZLE
AIR / NITROGEN PRESSURE SOURCE REGULATED UP TO 345 KPa (50 P.S.I.G.)
RECIRCULATION PUMP
AIR SUPPLY VALVE
RINSE SOLUTION TANK 19 LITERS (5 U.S. GALS) CAPACITY WORKING PR. 345 KPa (50 P.S.I.G.)
SHUT OFF VALVE

C12546A

Compressor Wash System - Schematic
Figure 703

- B & B 3100 (PWC11-001C)
- Turco 5884 (PWC11-001G)
- WCT Solution (Developed by PWC)

TABLE 703, Performance Recovery Solutions

Ambient Temperature		Cleaning Agent	Fuel	Methanol	Water
°F	°C	Qty (ml)	Qty (ml)	Qty (ml)	Qty (ml)
+36 up	+2 up	200	2000	Nil	2800
-13 to +36	-25 to +2	200	2000	1000	1800
Below -13	Below -25	200	2000	1800	1000

CAUTION: ADD 150 ML OF WITCONATE EMULSIFYING AGENT (PWC05-005) AND MIX SOLUTION THOROUGHLY BEFORE USE TO PREVENT FUEL SEPARATION.

NOTE: Approved Recovery Solutions for Table 703 are:

- Turco 4217 (PWC11-001F) (concentrate)
- Ardrox 624 (PWC11-001H) (concentrate)

NOTE: The above table results in 5 liters of power recovery solution. Multiply the 5 liters by approximately 4 to obtain 5 U.S. Gallons.

TABLE 704, WCT Performance Recovery Wash Solution (Developed by P&WC)

Material	Quantity
Witconate HC59B or P10-59B (PWC05-005)	2 parts
Carbitol (PWC11-001)	4 parts
Triethanolamine (PWC11-001)	1 part

TABLE 705, Biodegradable Performance Recovery Solutions

Ambient Temperature		Cleaning Agent	Methanol	Water
°F	°C	% by Vol.	% by Vol.	% by Vol.
+36 up	+2 up	20	NIL	80
-13 to +36	-25 to +2	20	30	50
Below -13	Below -25	20	40	40

NOTE: Approved Biodegradable Solutions for Table 705 are:

- Ardrox 6345 (PWC11-003)

- R-MC-G21 (PWC11-003A)
- Ardrox 6367 (PWC11-003B) previously identified as Turboclean 2
- Ardrox 6368 (PWC11-003C), previously identified as Turboclean 2 RTU, is a Ready To Use solution of 6367 mixed with water as recommended in Table 705 for ambient temperatures above 36°F (2°C). Do not further dilute solution by adding water.
- ZOK27 (PWC11-003D)
- B & B TC100 (PWC11-003E)
- Ardrox 6373 (PWC11-066) identified as Turboclean 2 RTU-W, is a Ready To Use - Winterized solution of 6367 mixed with water and methanol for ambient temperatures below -13°F (-25 °C). Do not further dilute solution by adding water and/or methanol.

D. Engine Preparation (Ref. Fig. 704)

CAUTION: LET A HOT ENGINE COOL FOR 30 MINUTES MINIMUM BEFORE DOING A COMPRESSOR WASH.

(1) Remove cap assembly (2) from Pt air tube assembly (1).

(2) Remove cap assembly (4) from P3 air tube assembly (3).

(3) Cover two P1/T1 probes in the engine inlet case with suitable waterproof protectors to prevent water from entering the probes.

(4) Disconnect and cap the P2.5 and P3 engine cabin bleed ports, on the aircraft side of the engine.

(5) Make sure throttle is in "CUT-OFF" position.

(6) Make sure ignition system is in the OFF position.

(7) Make sure aircraft bleed system is shut-off.

(8) Set the engine anti-ice switch to "OFF" position to prevent the compressor wash fluid from entering the valve piston.

E. Fan Washing

WARNING: BEFORE WASHING FAN, MAKE SURE STARTER SWITCH AND IGNITION SYSTEM ARE IN THE OFF POSITION AND TLA IS IN CUT OFF POSITION.

WARNING: WHEN WASHING THE FAN BY HAND WEAR CLEAN COTTON GLOVES AND USE CAUTION BECAUSE THE LEADING EDGE OF FAN BLADES MIGHT BE SHARP.

(1) Fan blade washing is best accomplished by hand using a sponge or soft clean cloth. Each blade must be washed individually on both pressure and suction side.

F. Compressor Washing (Desalination or Performance Recovery)

CAUTION: BEFORE MOTORING ENGINE, MAKE SURE ENGINE INTAKE IS CLEAR OF ALL LOOSE OBJECTS WHICH MAY BE INGESTED AND CAUSE ENGINE DAMAGE AND SUBSEQUENT FAILURE.

CAUTION: OBSERVE STARTER MANUFACTURER'S LIMITS DURING MOTORING (REF. STARTER MANUFACTURER'S MANUAL).

(1) Install compressor wash nozzle assembly (PWC61152), or fan wedges (PWC66581) if the alternative wash method (Wash Wand) is used. Refer to Para. B. - Preparation of Equipment.

(2) Check the air or nitrogen pressure supply connected to the wash rig is adjusted to 50 psig.

CAUTION: LET STARTER COOL BETWEEN RUNS (REF. STARTER MANUFACTURER'S MANUAL).

CAUTION: MAKE SURE ITT/T45 IS NOT MORE THAN 65°C (150°F) BEFORE DOING A COMPRESSOR WASH.

(3) Do a 30 second dry motoring run. When N2 reaches 5% during acceleration, start injecting wash fluid. Stop wash fluid injection when N2 drops below 5%. If the wash rig is correctly adjusted, 5 US Gal. of wash fluid will be used for each motoring run.

NOTE: It is not necessary to inject all of the fluid when a desalination is done. The remaining fluid can be used on other engine or disposed of accordingly.

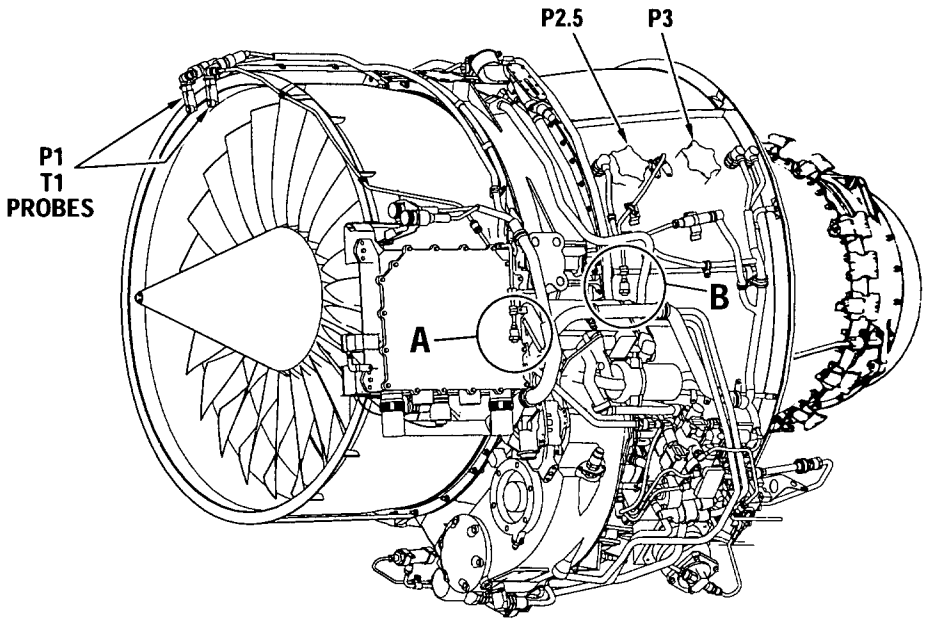
(4) Allow cleaning solution to soak for 5-10 minutes depending on temperature.

(5) Accomplish two 30 seconds dry motoring run, within the AFM Starter Duty Cycle limits, and start injecting rinse solution when N2 reaches 5%. Stop wash fluid injection when N2 drops below 5%. If the wash rig is correctly adjusted, 5 US Gal. of wash fluid will be used for each motoring run.

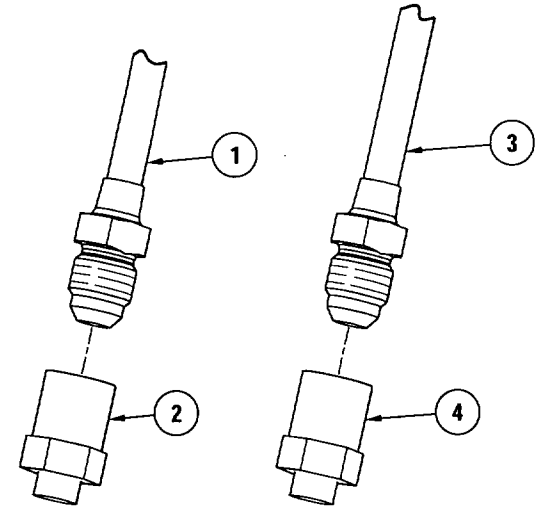
NOTE: Only one motoring run is required for desalination wash.

(6) Remove the compressor wash nozzle assembly (PWC61152) or the fan wedges (PWC66581).

(7) Perform a Post Compressor Wash (Ref. Para. G.).



POST-SB24434
PRE-SB24514



DETAIL A DETAIL B

C72968A

Preparation of Engine for Compressor Wash
Figure 704

Key to Figure 704

1. Pt Air Tube Assembly
2. Cap Assembly
3. P3 Air Tube Assembly
4. Cap Assembly

G. Post Compressor Washing (Ref. Fig. 704)

CAUTION: LET STARTER COOL BETWEEN RUNS (REF. STARTER MANUFACTURER'S MANUAL).

CAUTION: BEFORE MOTORING ENGINE, MAKE SURE THE COMPRESSOR WASH NOZZLE (PWC61152) OR THE FAN WEDGES (PWC66581) HAVE BEEN REMOVED AND SECURELY STORED. ALSO MAKE SURE THE INTAKE IS CLEAR OF ALL LOOSE OBJECTS THAT MAY BE INJECTED AND CAUSE ENGINE DAMAGE.

(1) Do a 30 seconds dry motoring run (Ref. Adjustment/Test).

(2) Install cap (4) on Pt air tube (3). Torque cap 90 to 100 lb.in. (10.0-11.0 Nm) and lockwire (PWC05-089).

(3) Install cap (2) on P3 tube (1). Torque cap 270 to 300 lb.in. (30.0-34.0 Nm) and lockwire (PWC05-089).

(4) Install P1/T1 probe and remove protective covers from P1/T1 sensors in fan case.

(5) Remove all bleed port caps. Allow sufficient time for wash solution to drain.

(6) Reconnect P2.5 and P3 cabin bleed ports.

CAUTION: MAKE SURE ALL COWLS ARE CLOSED.

(7) Do an engine start and run for 3 minutes at GROUND IDLE with CABIN BLEED OFF (Ref. Adjustment/Test).

(8) Shutdown engine.

H. Turbine Washing

(1) Remove one igniter plug and install turbine wash nozzle (PWC60708).

(2) Connect a wash rig to the spray nozzle and adjust air or nitrogen to 50 psig pressure (414 kPa).

CAUTION: ALLOW ENGINE TO COOL FOR A PERIOD OF 30 MINUTES PRIOR TO CARRYING OUT A TURBINE WASH.

CAUTION: BEFORE MOTORING ENGINE, ENSURE ENGINE INTAKE IS CLEAR OF ALL LOOSE OBJECTS WHICH MAY BE INGESTED AND CAUSE ENGINE DAMAGE AND SUBSEQUENT FAILURE.

CAUTION: OBSERVE STARTER MANUFACTURER'S LIMITS DURING MOTORING (REF. STARTER MANUFACTURER'S MANUAL).

(3) Do two 30 seconds dry motoring runs, one after the other, while injecting five gallons of wash fluid (Ref. Table 701) at a prescribed rate of 10 gallons per minute.

(4) Install previously removed igniter plug (REF. CHAPTER 74-10-01).

(5) Do a 30 seconds dry motoring run.

(6) Perform 5 min. engine ground run at ground idle.

CHAPTER

72

ENGINES

TABLE OF CONTENTS

SUBJECT	PAGE
ENGINE, GENERAL - DESCRIPTION AND OPERATION	**72-00-00**
1. Engine	1
2. Engine Data	10
A. Engine Specifications and Leading Particulars	10
B. Engine-Driven Accessories - Leading Particulars	10
C. Fuel System Specifications and Leading Particulars	10
D. Oil System Specifications	10
3. Approved Fuels	14
A. Use of Approved Fuels	14
B. High Temperature Stability	15
C. Quality	16
D. Additives	16
E. Approved Fuels (Unrestricted Use)	20
F. Acceptable Fuels (Restricted Use)	22
4. Approved Oils	23
A. General	23
B. Approved Oils	24
FAULT ISOLATION - 1	**72-00-00**
1. General	101
2. Abbreviations	101
3. Fault Isolation Figures	105
A. List of Figures	105
4. "P" and "J" Connector Locations	106
A. Description	106
5. Line Replaceable Units (LRUs) and Check/Servicing Procedures	113
A. Description	113

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
FAULT ISOLATION - 1 (Cont'd)	**72-00-00**
6. MFD Code Summary	114
A. Description	114
7. Electronic Engine Control (EEC)	120
A. Procedure	120
8. Multifunction Display (MFD) Logic Requirements (Post-SB24083)	121
A. Procedure	121
9. Full Authority Digital Electronic Control (FADEC) Multifunction Display (MFD)	122
A. Description	122
10. Fault Levels	124
A. Description	124
11. Major Code (LRU) Categories (Post-SB24083)	124
A. Description	124
FAULT ISOLATION - 2	**72-00-00**
1. MFD Codes 1A to 5M	101
A. List of Figures	101
FAULT ISOLATION - 3 (PRE-SB24434/POST-SB24514)	**72-00-00**
1. MFD Codes AA to WE	101
A. List of Figures	101
FAULT ISOLATION-4 (POST-SB24434/PRE-SB24514)	**72-00-00**
1. MFD Codes AB to WE	101
A. List of Figures	101
ENGINE - SERVICING	**72-00-00**
1. General	301
2. Consumable Materials	301

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
ENGINE - SERVICING (Cont'd)	**72-00-00**
3. Special Tools	301
4. Fixtures, Equipment and Supplier Tools	302
5. Oil System Servicing	302
A. General	302
B. Replacement of Oil with a Different Approved Brand	302
C. Blue Oil Dye	304
D. Oil Analysis	304
E. Warm Engine Oil Level Check	305
F. Cold Engine Oil Level Check	307
G. Oil System Drainage	309
H. Oil System Filling	313
I. Oil System Flushing	313
J. Chip Detector Inspection	314
K. Relocation of Oil Filler Neck	314
6. Preparation for Storage and Service	315
A. Shipping Container	315
B. Precautions	315
C. Removal of Engine from Container	316
D. Reactivation of Desiccant and Humidity Indicator	317
E. Installation of Engine in Shipping Container	317
7. Preservation/Depreservation	322
A. General	322
B. Preservation	322
C. Depreservation	323
8. Removal/Installation of Engine from/in Maintenance Stand	324

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
ENGINE - SERVICING (Cont'd)	**72-00-00**
A. Removal	324
B. Installation	325
9. Conversion of Engine for LH or RH Installation	325
A. Relocation of Oil Filler Neck	325
B. Relocation of Engine Mounts and Mount Pad Covers	342
ENGINE, GENERAL - INSPECTION	**72-00-00**
1. General	601
2. Consumable Materials	601
3. Special Tools	601
4. Fixtures, Equipment and Supplier Tools	601
5. Corrosion	601
6. Engine Overtemperature	602
7. Engine Overspeed	602
8. Engine Immersion in Water	602
9. Engine Dropped During Handling	602
10. Hot Section Inspection (HSI)	602
A. General	602
B. Summary of HSI Disassembly Procedures	602
C. Summary of HSI Inspection Criteria	603
D. Summary of HSI Assembly Procedures	605
11. Borescope Inspection	605
A. General	605
B. Inspection Tables	606
12. Variable Inlet Guide Vanes (VIGV)	606
A. Inspection	606

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
ENGINE, GENERAL - INSPECTION (Cont'd)	**72-00-00**
13. First-stage HP Compressor Blade	611
A. Inspection	611
14. Fourth-stage HP Compressor Blade	614
A. Inspection	614
15. Fuel Nozzles	621
A. Inspection	621
16. Combustion Chamber Liner	623
A. Inspection	623
17. First-stage HP Turbine Vane	632
A. Inspection	632
18. First-stage HP Turbine Blade	635
A. Inspection	635
19. Second-stage HP Turbine Blade	639
A. Inspection	639
20. Third-stage LP Turbine Vane	643
A. Inspection	643
21. Third-stage LP Turbine Blades	646
A. Inspection	646
22. Fifth-stage LP Turbine Blade	650
A. Inspection	650
23. Fifth-stage LP Turbine Vane	653
A. Inspection	653
24. HP Compressor Rotor	656
A. Borescope Inspection	656
25. Eddy Current Inspection (PW305A Only)	658

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
ENGINE, GENERAL - INSPECTION (Cont'd)	**72-00-00**
A. General	658
26. In-Service, Low Utilization Engine Inspection	665
A. Tier 1 Low Utilization Inspection	665
B. Tier 2 Low Utilization Inspection	668

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Feb 27/2009
	2	Feb 27/2009
	3	Feb 27/2009
	4	Feb 27/2009
	5	Feb 27/2009
	6	Feb 27/2009
Contents	1	Feb 27/2009
	2	Feb 27/2009
	3	Feb 27/2009
	4	Feb 27/2009
	5	Feb 27/2009
	6	Feb 27/2009
72-00-00 Description and Operation	1	Feb 15/2008
	2	Feb 15/2008
	3	Feb 15/2008
	4	Feb 15/2008
	5	Feb 15/2008
	6 blank	Feb 15/2008
	7	Feb 15/2008
	8 blank	Feb 15/2008
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	15	Feb 15/2008
	16	Feb 15/2008
	17	Feb 15/2008
	18	Feb 15/2008
	19	Feb 15/2008
	20	Feb 15/2008
	21	Feb 15/2008
	22	Feb 15/2008
	23	Feb 15/2008
	24	Feb 15/2008
	25	Feb 15/2008
	26	Feb 15/2008

CHAPTER SECTION	PAGE	DATE
72-00-00 Fault Isolation-1	101	Feb 15/2008
	102	Feb 15/2008
	103	Feb 15/2008
	104	Feb 15/2008
	105	Feb 15/2008
	106	Feb 15/2008
	107	Feb 15/2008
	108	Feb 15/2008
	109	Feb 15/2008
	110	Feb 15/2008
	111	Feb 15/2008
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	130	Feb 15/2008
	131	Feb 15/2008
	132	Feb 15/2008
	133	Feb 15/2008
	134	Feb 15/2008
	135	Feb 15/2008
	136	Feb 15/2008
	137	Feb 15/2008
	138	Feb 15/2008
	139	Feb 15/2008
	140	Feb 15/2008
	141	Feb 15/2008

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
	142	Feb 15/2008
	143	Feb 15/2008
	144	Feb 15/2008
	145	Feb 15/2008
	146	Feb 15/2008
	147	Feb 15/2008
	148	Feb 15/2008
	149	Feb 15/2008
	150	Feb 15/2008
	151	Feb 15/2008
	152	Feb 15/2008
	153	Feb 15/2008
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	167	Feb 15/2008
	168	Feb 15/2008
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	175	Feb 15/2008
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	177	Feb 15/2008
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	179	Feb 15/2008
	180	Feb 15/2008
	181	Feb 15/2008
	182	Feb 15/2008
	183	Feb 15/2008
	184 blank	Feb 15/2008
72-00-00	101	Feb 27/2009
Fault Isolation-2	102	Feb 27/2009
	103	Feb 27/2009
	104	Feb 27/2009
	105	Feb 27/2009
	106	Feb 27/2009
	107	Feb 27/2009
	108	Feb 27/2009
	109	Feb 27/2009
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	130	Feb 27/2009
	131	Feb 27/2009
	132	Feb 27/2009
	133	Feb 27/2009
	134	Feb 27/2009
	135	Feb 27/2009
	136	Feb 27/2009
	137	Feb 27/2009
	138	Feb 27/2009

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
72-00-00	101	Nov 28/2008
Fault Isolation-3	102	Nov 28/2008
	103	Nov 28/2008
	104	Nov 28/2008
	105	Nov 28/2008
	106	Nov 28/2008
	107	Nov 28/2008
	108	Nov 28/2008
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72-00-00	101	Nov 28/2008
Fault Isolation-4	102	Nov 28/2008
	103	Nov 28/2008
	104	Nov 28/2008
	105	Nov 28/2008
	106	Nov 28/2008
	107	Nov 28/2008
	108	Nov 28/2008
	109	Nov 28/2008

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE	CHAPTER SECTION	PAGE	DATE
	110	Nov 28/2008		151	Nov 28/2008
	111	Nov 28/2008		152	Nov 28/2008
	112	Nov 28/2008		153	Nov 28/2008
	113	Nov 28/2008		154	Nov 28/2008
	114	Nov 28/2008		155	Nov 28/2008
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	118	Nov 28/2008		159	Nov 28/2008
	119	Nov 28/2008		160	Nov 28/2008
	120	Nov 28/2008			
	121	Nov 28/2008	72-00-00	301	Nov 28/2008
	122	Nov 28/2008	Servicing	302	Nov 28/2008
	123	Nov 28/2008		303	Nov 28/2008
	124	Nov 28/2008		304	Nov 28/2008
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	147	Nov 28/2008		327	Nov 28/2008
	148	Nov 28/2008		328	Nov 28/2008
	149	Nov 28/2008		329	Nov 28/2008
	150	Nov 28/2008		330	Nov 28/2008

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
	331	Nov 28/2008
	332	Nov 28/2008
	333	Nov 28/2008
	334	Nov 28/2008
	335 blank	Nov 28/2008
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72-00-00 Inspection Check	601	Feb 27/2009
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	657	Feb 27/2009
	658	Feb 27/2009
	659	Feb 27/2009
	660	Feb 27/2009
	661	Feb 27/2009
	662	Feb 27/2009
	663	Feb 27/2009
	664	Feb 27/2009
	665	Feb 27/2009

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
	666	Feb 27/2009
	667	Feb 27/2009
	668	Feb 27/2009
	669	Feb 27/2009
	670	Feb 27/2009

P&WC Proprietary Information. Subject to the restrictions on the title page.

ENGINE, GENERAL - DESCRIPTION AND OPERATION

1. Engine (Ref. Figs. 1 through 6)

The PW305 Engine is a two-spool, turbofan engine, featuring a full-length annular bypass duct. A concentric shaft system supports the high and low pressure rotors. The inner shaft supports the low pressure (LP) compressor (fan) and is driven by a three-stage turbine at the rear. The outer shaft is mechanically independent of the LP shaft and supports the four axial stages and one centrifugal stage of the high pressure (HP) compressor, and is driven by a two-stage turbine supported at the rear.

Air enters the engine through the fan case, is accelerated rearwards by the fan and is split into bypass and core flow streams through concentric dividing ducts. The bypass air passes through a single stage of stators and a faired bypass duct before exiting with the core flow through a common mixing nozzle.

The core airflow passes through variable inlet guide vanes and first-stage variable stator vanes, which allow optimum airflow into the HP compressor. Both sets of vanes are hydraulically actuated by fuel pressure from the hydro-mechanical unit, as commanded by the electronic engine control. From the HP compressor, core airflow is passed through 24 diffuser tubes, which convert velocity to static pressure. The diffused air then passes to the annulus surrounding the combustion chamber liner.

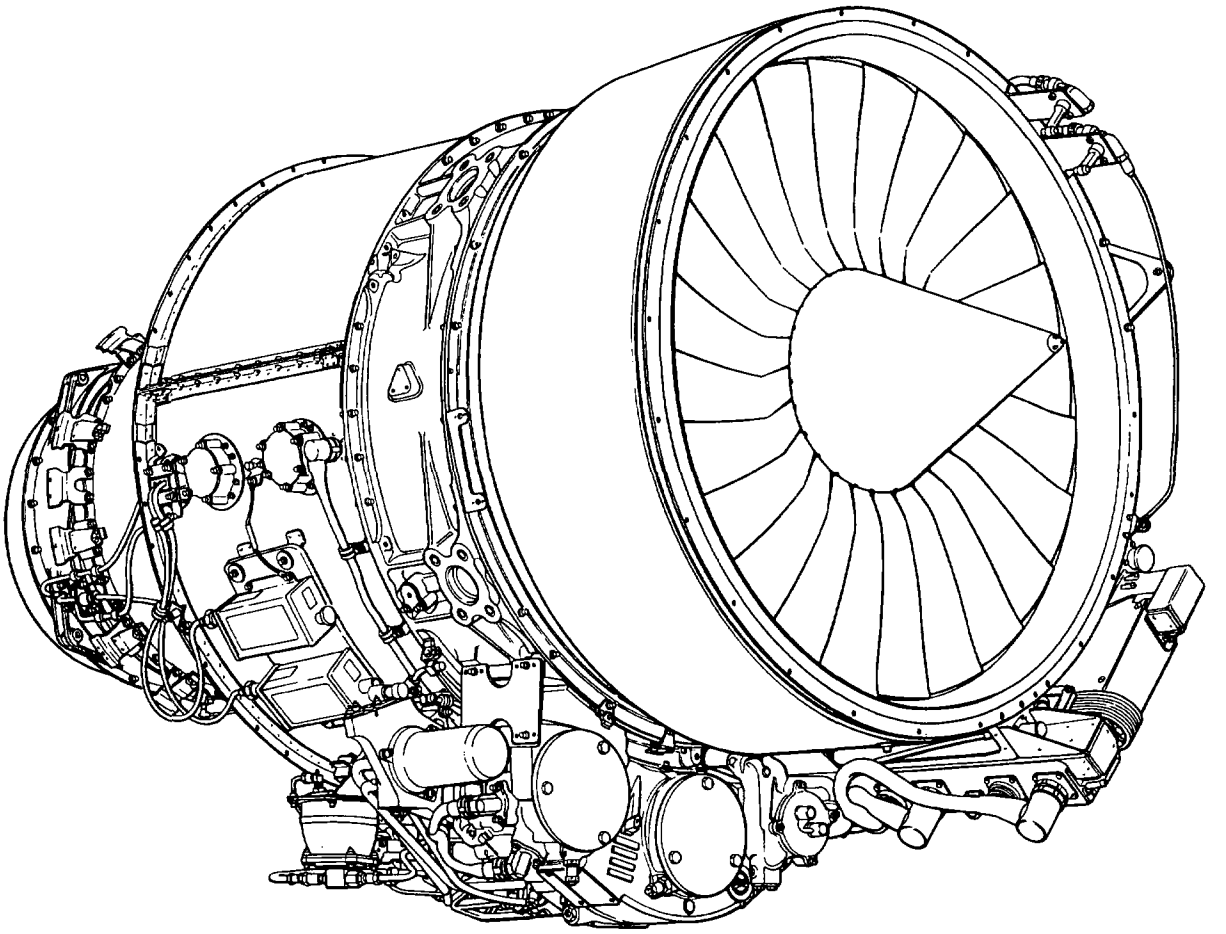
The combustion chamber liner consists of an annular straight-through assembly, with multi-holed patterns for air mixing and dilution with the combustion gases.

The air enters the combustion chamber liner and mixes with fuel. Fuel is injected into the combustion chamber by 24 air blast nozzles supplied by a single-tube manifold. Two of the nozzles are a hybrid-type, having an additional fuel supply line of lower pressure, to provide a separate primary fuel flow for ease of starting. During starting, the mixture is ignited by two spark igniters which protrude into the combustion chamber liner.

The resultant gases expand from the combustion chamber liner and pass through the first-stage HP turbine stator to the first-stage HP turbine. The first-stage HP vanes and rotor blades are cooled by air flowing through internally cast passages. The still expanding gases pass rearward to the second-stage HP vanes and turbine, then to the three-stage LP turbine and associated stator vanes, then to atmosphere through the exhaust duct, subsequently mixing with the bypass flow.

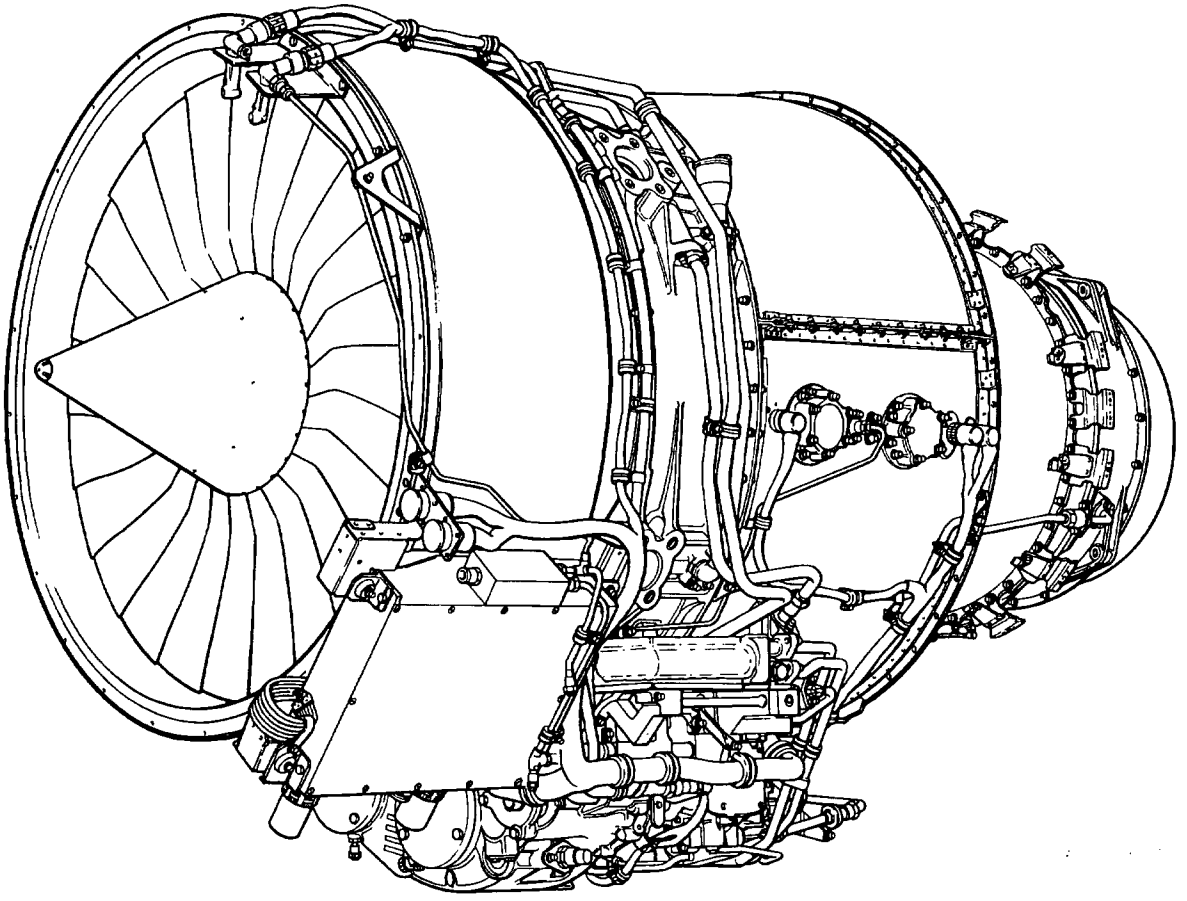
All engine driven accessories (Ref. Table 1), with the exception of the N1 LP rotor speed sensor, are on the accessory gearbox secured to the bottom of the intermediate case. The accessories are driven by a tower driveshaft geared to the HP rotor shaft (N2), passing downward through the intermediate casing to mesh with a bevel gear in the accessory gearbox. The N2 speed sensors located on the right side of the accessory gearbox are of an electromagnetic pulse type. A spur gear on the alternator gearshaft passes over the probes, creating an impulse which is transmitted to the EEC. The N1 speed sensors are mounted in the aft end of the engine, in the exhaust case. The operation of the N1 probes is the same as the N2 probes, and transmits signals to the EEC.

The engine oil tank is integral with the intermediate case and is located between the core and bypass flow passages.



C18600

PW305 Engine - Three-quarter View (Right Side)
Figure 1



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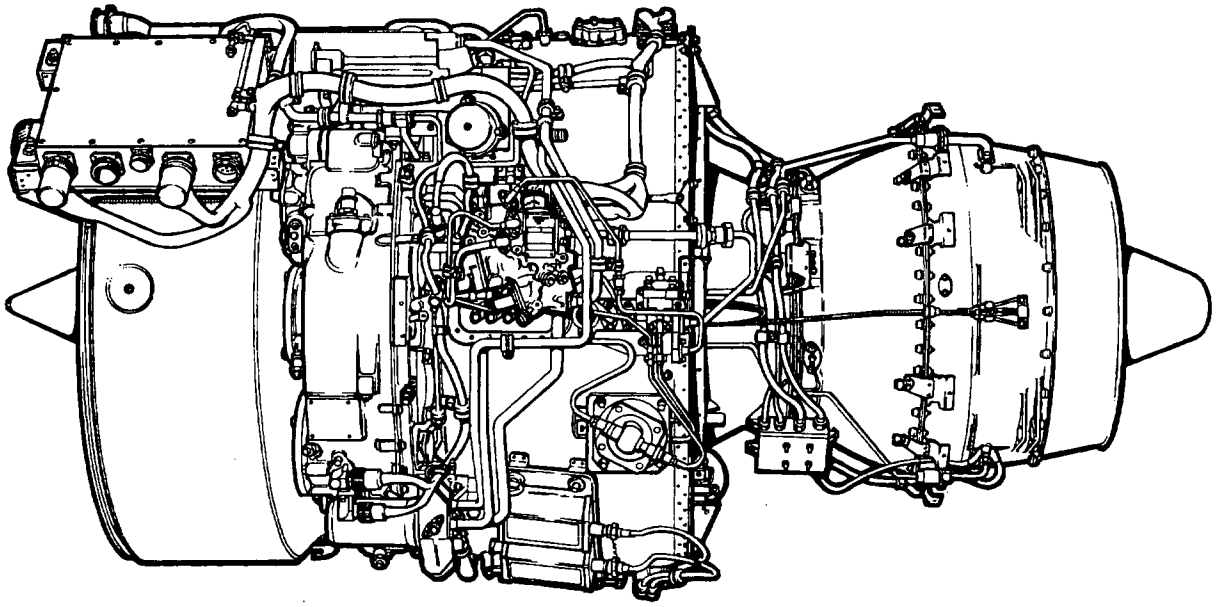
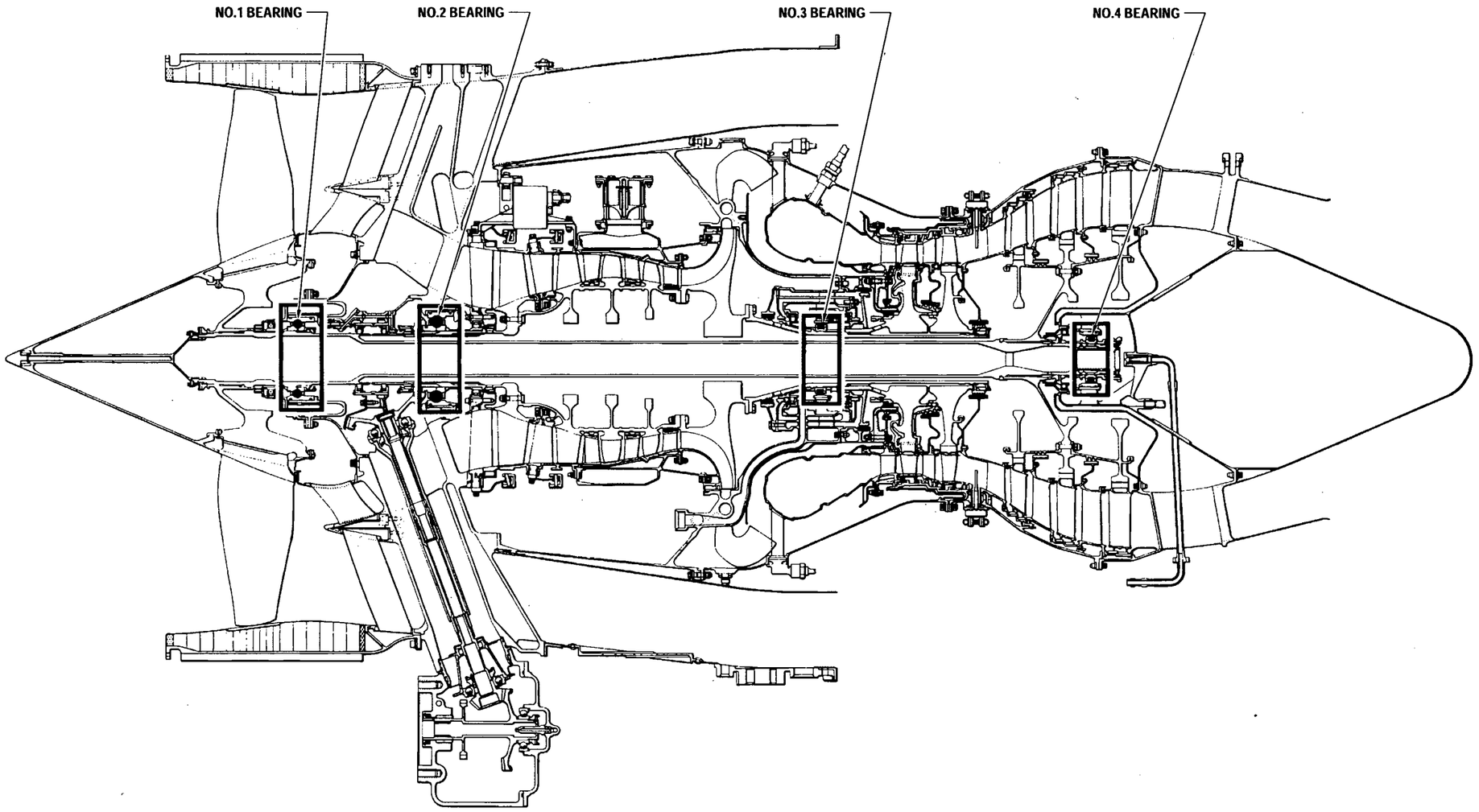
PW305 Engine - Three-quarter View (Left Side)
Figure 2



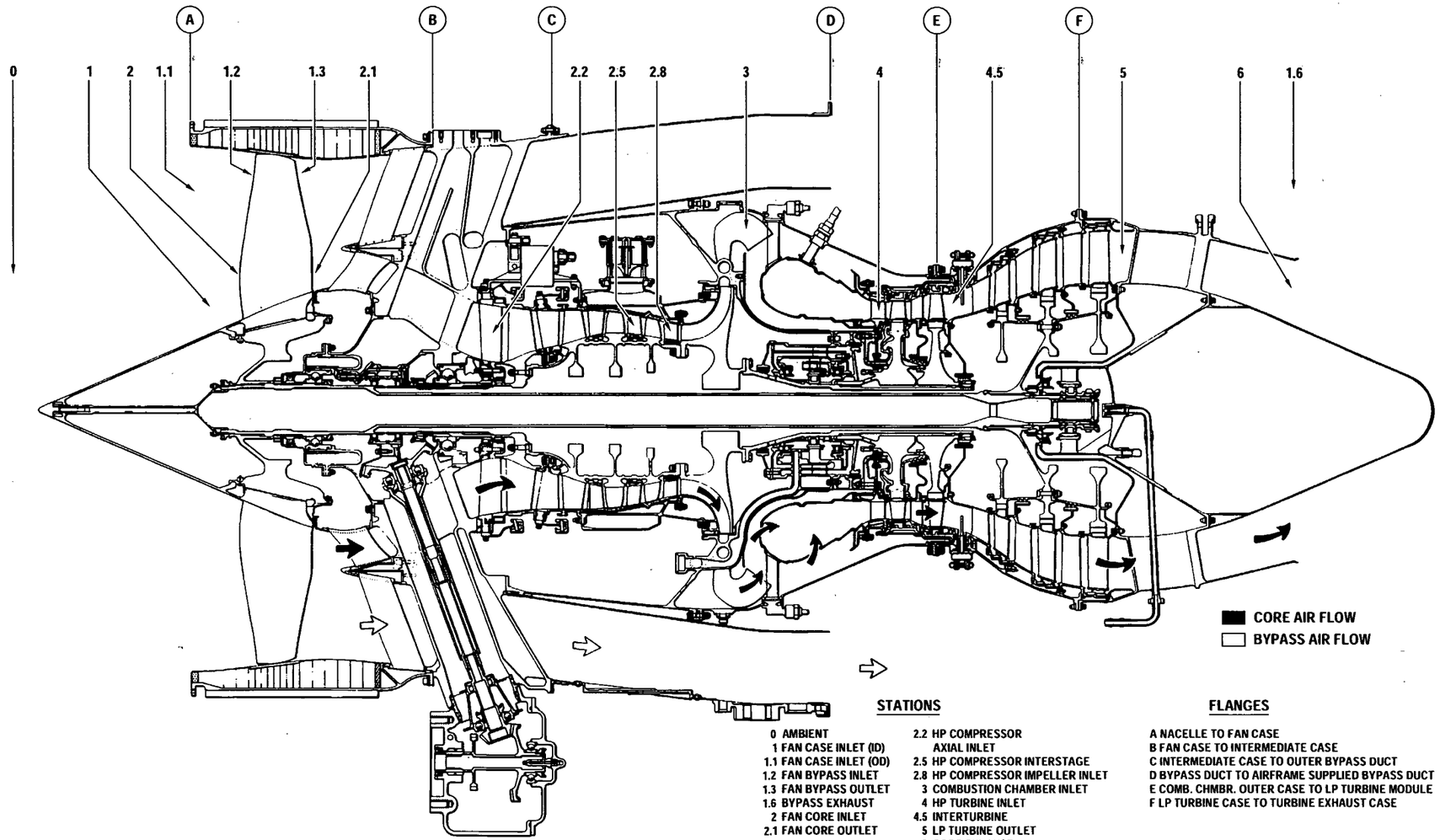
C18601

PW305 Engine - Bottom View
Figure 3



C17781

Engine Cross Section and Bearings
Figure 4



STATIONS

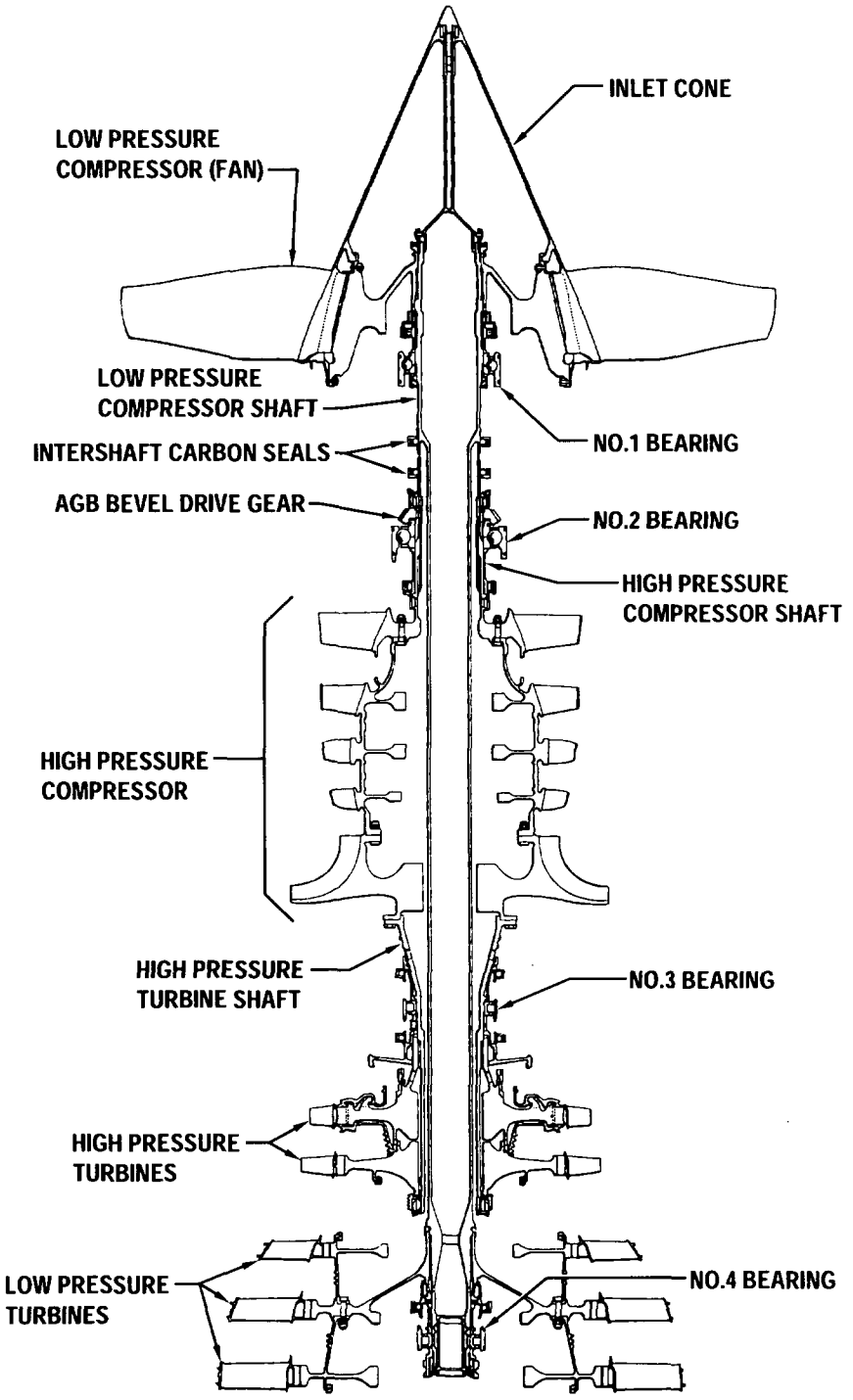
0 AMBIENT
1 FAN CASE INLET (ID)
1.1 FAN CASE INLET (OD)
1.2 FAN BYPASS INLET
1.3 FAN BYPASS OUTLET
1.6 BYPASS EXHAUST
2 FAN CORE INLET
2.1 FAN CORE OUTLET
2.2 HP COMPRESSOR AXIAL INLET
2.5 HP COMPRESSOR INTERSTAGE
2.8 HP COMPRESSOR IMPELLER INLET
3 COMBUSTION CHAMBER INLET
4 HP TURBINE INLET
4.5 INTERTURBINE
5 LP TURBINE OUTLET
6 CORE EXHAUST

FLANGES

A NACELLE TO FAN CASE
B FAN CASE TO INTERMEDIATE CASE
C INTERMEDIATE CASE TO OUTER BYPASS DUCT
D BYPASS DUCT TO AIRFRAME SUPPLIED BYPASS DUCT
E COMB. CHMBR. OUTER CASE TO LP TURBINE MODULE
F LP TURBINE CASE TO TURBINE EXHAUST CASE

C17783

Engine Cross Section, Air Flow, Flanges and Stations
Figure 5



C17782

Main Bearings and Shafting
Figure 6

2. Engine Data

A. Engine Specifications and Leading Particulars

(1) Refer to Chapter 5-10-00.

B. Engine-Driven Accessories - Leading Particulars

(1) Refer to Table 1 and Figure 7 for leading particulars for engine-driven accessories and accessory drives.

(2) All engine driven accessories, with the exception of the LP rotor speed sensors are mounted on the accessory gearbox and driven by a tower shaft geared to the HP rotor.

(3) All ratios and rpm values are relative to input speeds from the HP rotor and, for the N1 speed sensor, the LP rotor as follows:

(a) HP rotor - 100 percent N2 26,930 rpm.

(b) LP rotor - 100 percent N1 10,608 rpm.

C. Fuel System Specifications and Leading Particulars

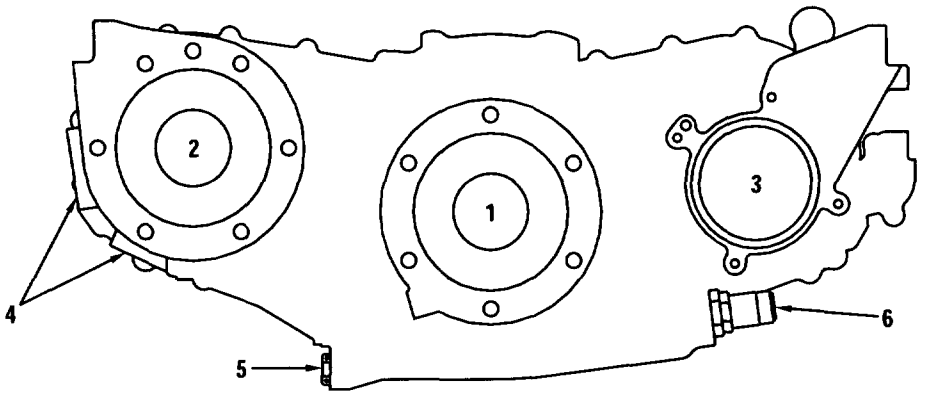
(1) The engine fuel system specifications and leading particulars are detailed in Para. 3. and Tables 2 through 5.

D. Oil System Specifications

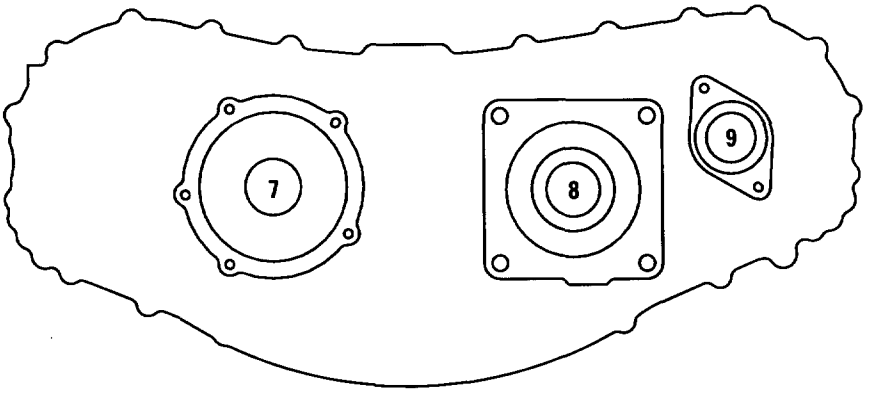
(1) The engine lubrication system specifications and leading particulars are detailed in Para. 4. and Tables 6 and 7.

TABLE 1, Engine-driven Accessories

Accessory	Rotation (looking towards pad)	Ratio	RPM
Input (100% N2 (HP Rotor))	-	-	26930
Towershaft	-	1.0339	27843
Starter-generator	CW	0.4364	12150
AC Generator and Fuel Pump	CW	0.9268	11261
Oil Pumps	CW	0.2875	3237
Hydraulic Pump	CW	0.6441	7825
Alternator (Breather and N2 Speed Sensors)	CW	1.5526	12150



FRONT VIEW



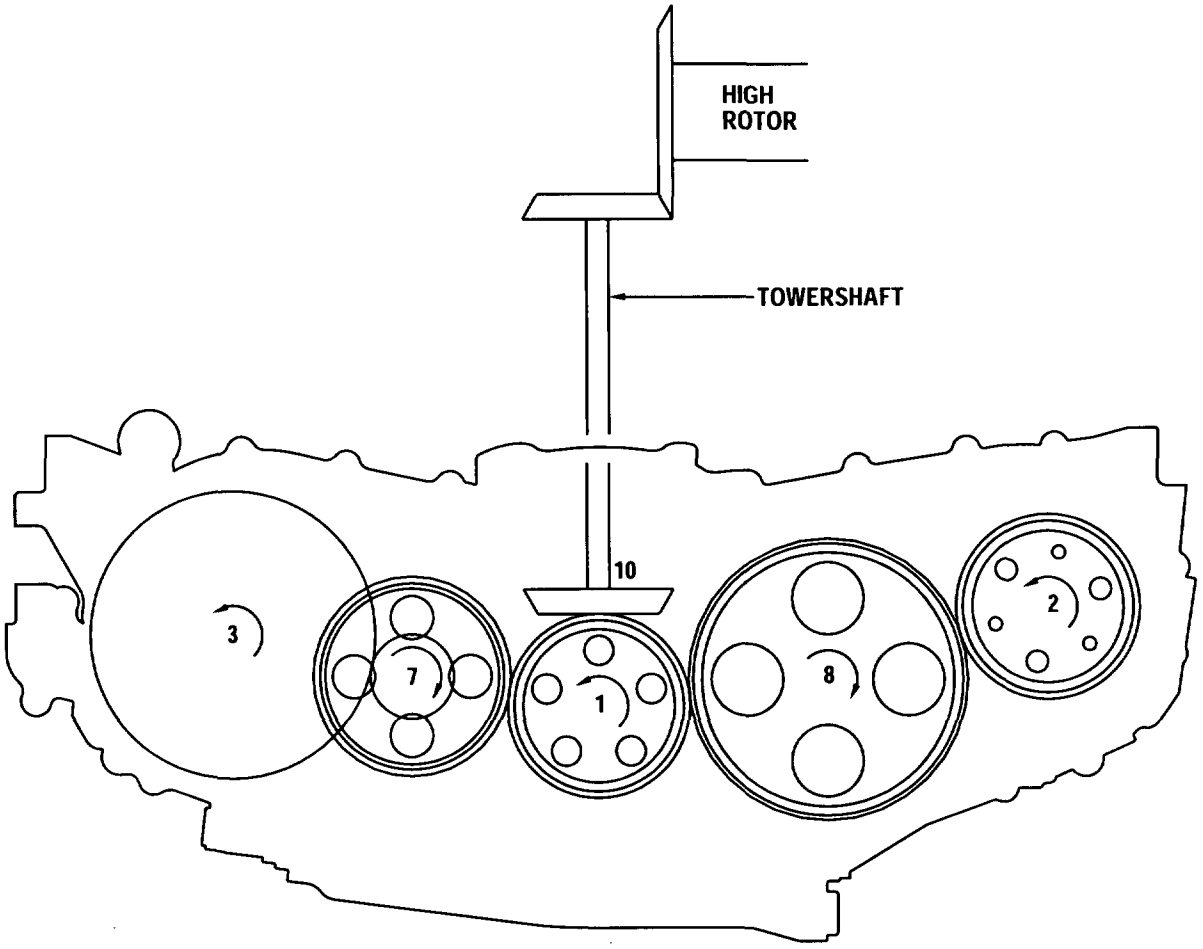
REAR VIEW

C30335

Accessory Gearbox Pad Locations and Geartrain
Figure 7 (Sheet 1 of 2)

Key to Figure 7

1. Starter-generator
2. Alternator
3. Oil Pump Assembly
4. N2 Speed Sensors
5. AGB Oil Drain
6. Chip Detector
7. AC Generator and Fuel Pump
8. Hydraulic Pump
9. Breather



C30336A

Accessory Gearbox Pad Locations and Geartrain
Figure 7 (Sheet 2)

3. Approved Fuels

A. Use of Approved Fuels

(1) The fuels specified in Table 10 are recommended by P&WC. Airworthiness authorities normally require operators to follow these recommendations unless alternative fuels have been agreed between the operator and P&WC and approval by the operators airworthiness authority.

(2) The fuels recommended have been substantiated by P&WC specifications and are Transport Canada approved.

(3) The fuel properties specified in Table 2 are the minimum requirements that are accepted for use. As these properties only meet minimum engine requirements, the list is not intended for use as a purchase specification for procurement of fuel for P&WC commercial engines. Rather, it is intended to allow operators to include minimum approved fuel requirements for P&WC engines in conjunction with other functional requirements when formulating their own procurement specification or judging the acceptability of fuels manufactured to other national specifications that exist throughout the world.

(4) Technical requirement tests shall be performed, in accordance with the latest issue of the listed American Society for Testing and Materials (ASTM) test methods.

TABLE 2, Fuel Properties

Properties		Limits	Test Method
Gravity, deg API at 59°F (15°C)		37 (0.84 Kg per l) to 57 (0.75 Kg per l)	ASTM D287 D1298 D4052
Distillation Temperature			ASTM D86
	10% Evaporated	Max. 401°F (205°C)	-
	50% Evaporated	Max. 450°F (232°C)	-
	End Point	Max. 572°F (300°C)	-
	Loss	Max. 1.5%	-
	Residue	Max. 1.5%	-
Sulfur		Max. 0.40 % by Weight	ASTM D1266 D1552 D2622 D4294 D5453
Mercaptan Sulfur		Max. 0.005% by Weight (See Note 1)	ASTM D3227

TABLE 2, Fuel Properties (Cont'd)

Properties	Limits	Test Method
Net Heat of Combustion,	Min. 18,300 BTU/lb Min. 42.6×10^6 J/kg	ASTM D240 D1405 D2382 D3338 D4529 D4809
Freezing Point	Max. -40°F (-40°C)	ASTM D2386
Reid Vapour Pressure	Max. 3 psi (21kPa)	ASTM D323
Aromatic Content	Max. 25 % by volume	ASTM D1319
Burning Quality		
Luminometer No.	Min. 45	ASTM D1740
or Smoke Point	Min. 25 mm	ASTM D1322
or Smoke Point plus Napthalenes	Min. 20 mm. plus 3% by volume max.	ASTM D1322 D1840
Copper Strip Corrosion	Max. No. lb. at 212°F (100°C), for 2 hrs	ASTM D130
Viscosity	Max. 16.5 cs at -30°F (-35°C)	ASTM D445
Water Reaction, Volume Change,	Max. 1 ml	ASTM D1094
Water Reaction, Interface rating	Max. 1-b	ASTM D1094

NOTE: 1. Mercaptan Sulfur determination may be omitted provided Doctor Test in accordance with ASTM D4952 is conducted and results are negative.

B. High Temperature Stability

(1) The Jet Fuel Thermal Oxidation Tester, JFTOT, ASTM D3241, will be used to test thermal stability. Maximum pressure change shall be 1.0 inch (25.4 mm) Hg and Tube Deposit shall be less than Code 3 at the following conditions:

(a) Fuel Pressure: 500 psi (3447.4 kPa).

(b) Fuel flow rate: 2.85 US gal/hr (3 ml/min.).

(c) Test time: 150 minutes.

(2) If JFTOT test at control temperature of 500°F (260°C) fails to meet specification requirements, then test shall be conducted at a temperature of 473°F (245°C).

C. Quality

(1) The results from both the 500°F and 473°F (260°C and 245°C) control temperature tests (Ref. Subpara. B. preceding), must be reported by the refiner on all fuel analysis reports.

(2) Fuel shall consist solely of hydrocarbon compounds except as otherwise specified herein. It shall be clear and free of undissolved water, sediment, and suspended matter, and shall be suitable for use in aircraft turbine engines.

(3) The odor of the fuel shall not be nauseating or irritating. No substances of known dangerous toxicity under usual conditions of handling and use shall be used.

D. Additives

(1) One or a combination of the following oxidation inhibitors may be added to the basic fuel in total concentration not greater than 25 milligrams per liter (0.025 g/l) to prevent formation of gum.

(a) 2, 4-dimethyl-6-tertiary-butyl phenol.

(b) 2, 6-ditertiary-butyl-4-methyl phenol.

(c) 2, 6-ditertiary-butyl phenol.

(d) 75% min. 2,6-ditertiary-butyl phenol, plus 25% max. mixed tertiary and tritertiary-butyl phenols.

(e) 72% min. 2,4-dimethyl - 6 tertiary butyl phenol, 28% max. monomethyl and dimethyl tertiary butyl phenol.

(f) 55% min. 2,4-dimethyl-6-tertiary-butyl phenol, plus 15% min. 2,6-ditertiary-burtyl-4-methyl phenol, remainder as monomethyl and dimethyl tertiary-butyl phenols.

(g) Agidol 1.

(2) The following additives in addition to the oxidation inhibitors listed above are acceptable for use in engine fuel subject to the limitations stated.

(a) Anti-corrosion and lubricity additives in the following tables of this sub-section are described as being primary corrosion inhibitors and secondarily as lubricity improvers, to meet a U.S. Military Specification. In certain cases it is necessary to adjust concentration of such additives to obtain necessary lubricity improvement. Only products listed in Table 3 have been tested and approved, by P&WC as both corrosion inhibitors and lubricity improvers, at the concentration specified.

1 Anti-corrosion Additives (Ref. Table 3)

NOTE: These fuel additives were approved on the basis of information received from manufacturers or suppliers of the additives. Analysis of this information and results of tests on product samples have indicated no significant adverse effect on engine materials provided the concentration does not exceed the recommended maximum. The following corrosion inhibitors are approved for the concentrations listed:

2 Anti-corrosion and Fuel Lubricity Improver Additives (Ref. Table 4)

NOTE: Extensive operation on low lubricity fuel can result in accelerated engine fuel pump wear. Until a generally accepted method of measuring and defining fuel lubricity is available, rapid fuel pump wear should be considered an indication of low lubricity fuel and dictates a change in the fuel or addition of a lubricity improver. The following corrosion inhibitor and fuel lubricity improver additives are approved for the concentrations listed.

a Table 5 specifies a thermal stability additive, approved for use in engine fuel, at the option of refiner, to ensure adequate high temperature stability at time of use.

b Table 6 specifies an approved metal deactivator.

WARNING: THESE FUEL SYSTEM ANTI-ICING ADDITIVES CONTAIN ETHYLENE GLYCOL MONOETHYL ETHER WHICH IS HIGHLY TOXIC. THESE PRODUCTS MUST BE HANDLED WITH EXTREME CARE. AVOID ALL DIRECT CONTACT WITH SKIN OR CLOTHING. ANY CLOTHING WHICH IS ACCIDENTALLY CONTAMINATED BY SPLASHING SHOULD BE PROMPTLY REMOVED AND THE SKIN WASHED WITH SOAP AND WATER. PREVENT CONTACT WITH EYES AND AVOID INHALATION OF VAPOURS. IF CONTACT IS MADE WITH EYES THEY SHOULD BE FLUSHED WITH WATER FOR 15 MINUTES. CONSULT WITH A PHYSICIAN AS RAPIDLY AS POSSIBLE AFTER ALL CONTACT CASES.

3 Any anti-icing additive which is directly equivalent to those listed in Table 7 is approved.

4 Table 8 specifies approved anti-static additives.

5 Anti-microbial Organisms Additive (Ref. Table 9).

a Airline Operation

The following biocide additive may be used on a limited basis. Limited basis is defined as intermittent or non-continuous use in a single application to sterilize aircraft systems suspected or found to be contaminated by microbial organisms, such as fungi, bacteria and yeasts. For those operators, where the need for biocide use is indicated (blocked LP filters), P&WC recommends, as a guide, a dosage interval of once a month. This interval can then be adjusted, either greater or lesser, as the operator's own experience dictates.

b Executive Aircraft Operation

The additive may be used continuously in executive aircraft where utilization is less than 1200 hours per year.

TABLE 3, Anti-corrosion Additives

Additive (Trade Name)	Maximum Concentration Grams per 10,000 Liters
Dupont AFA-1	456
Dupont DCI-4A	225
Lubrizol 541	570
Nalco 5400-A	228
Nalco 5403	225
Petrolite TOLAD 245	570

TABLE 4, Anti-corrosion and Fuel Lubricity Improver Additives

Additive (Trade Name)	Maximum Concentration Grams per 10,000 Liters
Apollo PRI-19	225
Cooper Hitec E-580	225
Mobilad F-800	225
Haitek-580	225

TABLE 5, Thermal Stability Additives

Additive (Trade Name)	Minimum Effective Concentration mg/litre	Maximum Effective Concentration mg/litre
Octel JFA-5 (See Note 1) or		11

TABLE 5, Thermal Stability Additives (Cont'd)

Additive (Trade Name)	Minimum Effective Concentration mg/litre	Maximum Effective Concentration mg/litre
BetzDearborn Spec Aid 8Q462 (see Note 2) or	256	300
Aeroshell Performance Additive 101 (See Note 2) or	256	300
Spec Aid 8Q462 or	256	300
Turboline FS100 (concentrate) (See Note 2) or	256	300
Turboline FS100 (diluted) (See Note 2)	533	625

NOTE: 1. Approved for use in engine fuel at the option of the refiner to ensure adequate high temperature stability at time of use.

NOTE: 2. Approved for use in engine fuel at the option of the refiner and has been shown to improve jet fuel thermal stability, in some applications to significantly reduce fuel nozzle coking and to improve hot section cleanliness. This additive consists of an antioxidant, a metal deactivator and a dispersant.

TABLE 6, Metal Deactivator

Additive (Trade Name)	Maximum Concentration Grams per 10,000 Liters
N, N1 - Disalicylidene - 1, 2 Propane - Diamine	57

TABLE 7, Anti-icing Additives

Additive (Trade Name)	Maximum Concentration Percentage by Volume
Phillips PFA 55MB	0.15
Ethylene Glycol	0.15

TABLE 7, Anti-icing Additives (Cont'd)

Additive (Trade Name)	Maximum Concentration Percentage by Volume
Monomethyl Ether as Defined in MIL-I-27686	-
MIL-I-85470	0.15
Fluid I and Fluid IM	0.30

TABLE 8, Anti-static Additives

Additive (Trade Name)	Maximum Concentration Parts per Million by Weight
Shell ASA3	1.0
Dupont Stadis 450	3.0

TABLE 9, Anti-microbial Organisms Additives

Additive (Trade Name)	Maximum Concentration Parts per Million by Weight
Biobor JF	270

E. Approved Fuels (Unrestricted Use)

(1) Fuels listed in Table 10 comply with P&WC specifications and are approved for unrestricted use in PW300 engines.

NOTE: 1. Unless otherwise specified, the latest issue of fuel specifications applies.

NOTE: 2. An approved fuel, or any mixture of approved fuels may be used.

TABLE 10, Approved Fuels - Unrestricted Use

Issuing Authority Body	Kerosene Type	Freeze Point °F (°C)	Wide Cut Type	Freeze Point °F (°C)	High Flash Kerosene Type	Freeze Point °F (°C)
Associations						
ASTM (D1655)	Jet A	–40 (–40)	Jet B	–58 (–50)	-	-
	Jet A-1	–53 (–47)	-	-	-	-

TABLE 10, Approved Fuels - Unrestricted Use (Cont'd)

Issuing Authority Body	Kerosene Type	Freeze Point °F (°C)	Wide Cut Type	Freeze Point °F (°C)	High Flash Kerosene Type	Freeze Point °F (°C)
IATA	Kerosene Type Fuel	–53 (–47)	Wide Cut Type Fuel	–58 (–50)	-	-
Military						
US MIL-DRF-5624	-	-	JP-4 (See Note 1)	–72 (–58)	JP-5 (See Note 1)	–51 (–46)
US MIL-DTL-83133	JP-8 (See Note 1)	–53 (–47)	-	-	-	-
	JP-8+100 (See Note 3)	–53 (–47)				
British Joint Services Designation	AVTUR (See Note 2)	N/A	AVTAG (See Note 2)	N/A	AVCAT (See Note 2)	N/A
	AVTUR/FSII (See Note 1)	N/A	AVTAG/FSII (See Note 1)	N/A	AVCAT/FSII (See Note 1)	N/A
NATO Code	F34 (See Note 1)	–53 (–47)	F40 (See Notes 1 and 2)	–72(–58)	F43	N/A
	F35	–53 (–47)	-	-	F44 (See Notes 1 and 2)	-51 (-46)
Canadian General Standards Board	CAN/ C.G.S.B. 3.23	–53 (–47)	CAN/ C.G.S.B. 3.22	–51 (–60)	CAN/ C.G.S.B. 3 GP-24M	–51 (–46)
British Ministry of Defence	DERD 2453 (See Note 1)	–53 (–47)	DERD 2454 (See Note 1)	–72 (–58)	DERD 2452 (See Note 1)	–51 (–46)
	DERD 2494	–53 (–47)	-	–72 (–58)	DERD 2498	–51 (–46)
French Ministry of the Armed Forces	AIR 3405	–58 (–50)	AIR 3407	–72 (–58)	AIR 3404	–51 (–46)
Governments						

TABLE 10, Approved Fuels - Unrestricted Use (Cont'd)

Issuing Authority Body	Kerosene Type	Freeze Point °F (°C)	Wide Cut Type	Freeze Point °F (°C)	High Flash Kerosene Type	Freeze Point °F (°C)
Russia Standards Organization GOST 10227	RT	–59 (–50)	-	-	-	-
JUS.B.H2.331	GM-1	–55 (–48)	-	-	-	-
Ukrainian GSTU 320.00149943.007-97	RT	–59 (–50)	-	-	-	-
China	RP-3	–53 (–47)	-	-	-	-

NOTE: 1. Contains Fuel System Icing Inhibitor (FSII).

NOTE: 2. These designations are not specifications, therefore there are no freeze point definitions.

NOTE: 3. F34, JP-8 type kerosene turbine fuel which contains thermal stability improver additives (Ref. Table 5).

F. Acceptable Fuels (Restricted Use)

(1) Fuels listed in Table 11 are considered by P&WC to be satisfactory for occasional use only.

NOTE: 1. Unless otherwise specified, the latest issue of fuel specifications applies.

NOTE: 2. An acceptable fuel, or any mixture of acceptable fuels may be used.

TABLE 11, Acceptable Fuels - Restricted Use

Issuing Authority Body	Kerosene Type	Freeze Point °F (°C)	Wide Cut Type	Freeze Point °F (°C)	High Flash Kerosene Type	Freeze Point °F (°C)
Governments						
Russia Standards Organization GOST 10227 (See Note 1)	TS-1	–76 (–60)	-	-	-	-

TABLE 11, Acceptable Fuels - Restricted Use (Cont'd)

Issuing Authority Body	Kerosene Type	Freeze Point °F (°C)	Wide Cut Type	Freeze Point °F (°C)	High Flash Kerosene Type	Freeze Point °F (°C)
Ukrainian GSTU 320.00149943.007-99 (See Note 1)	TS-1	–76 (–60)	-	-	-	-

NOTE: 1. If these fuels are to be used in PW300 turbine engine for more than 1000 hours, intermittently, or continuously, a borescope inspection of the hot section, and flow and visual inspection of the fuel nozzles must be done between 500 and 1000 hours of accumulated running time.
To enable continued use of this fuel in excess of 1000 hours, the results of the inspections must be acceptable to P&WC.
Borescope inspection requirements are available from P&WC.

4. Approved Oils

A. General

NOTE: P&WC does not recommend the casual mixing of different brands or types of oil. If oil mixing is necessary, refer to the related text below, Chapter 72-00-00, Engine - Servicing and Chapter 05-20-00, SCHEDULED MAINTENANCE CHECKS.

(1) Refer to Chapter 05-20-00, SCHEDULED MAINTENANCE CHECKS for oil drain interval and Chapter 72-00-00, Engine - Servicing for oil system servicing.

(2) Major factors affecting oil deterioration over time are engine mechanical condition, climatic, atmospheric and environmental conditions, dust and sand ingestion during take-off/landing modes and engine utilization.

(3) Oil System Servicing

(a) On expiry of approved oil drain period, drain complete oil system (Ref. Engine - Servicing) and refill (Ref. Engine - Servicing).

(b) When switching to another approved brand, drain (Ref. Engine - Servicing) and flush complete oil system (Ref. Engine - Servicing) and refill (Ref. Engine - Servicing).

(c) If oils of non-approved brands, or of different viscosities become mixed, drain (Ref. Engine - Servicing) and flush complete oil system (Ref. Engine - Servicing) and refill with an approved oil Engine - Servicing.

(d) If it is necessary to replenish oil consumption losses when oil of the same brand (as tank contents) is unavailable, then the following requirements apply: for contingency purposes, oil replenishment with any other approved oil brand listed is acceptable provided:

1 The total quantity of added oil does not exceed 2 U.S. quarts/2.4 Imp. quarts (1.88 liters), in any 600 hour period.

2 If it is required to add more than 2 U.S. quarts/2.4 Imp. quarts (1.88 liters) of dissimilar oil brands, the instructions in step (c) apply.

(e) If an operator wishes to monitor oil quality, it is recommended that a program be established in collaboration with the operator's oil supplier/manufacturer.

B. Approved Oils

(1) 5 Centistoke Oils

(a) The oils listed (Ref. Table 12), comply with specification PWA 521, Type II Oil (5Cs). These oils are fully approved for use in PW300 engines.

CAUTION: WHEN CHANGING FROM AN EXISTING LUBRICANT FORMULATION TO A "THIRD GENERATION" LUBRICANT FORMULATION (SEE TABLE 13), P&WC STRONGLY RECOMMENDS THAT SUCH A CHANGE SHOULD ONLY BE MADE WHEN AN ENGINE IS NEW OR FRESHLY OVERHAULED.

(2) Third Generation Oils

(a) The term "Third Generation" is one that oil companies use to describe turbine oils which they claim to have superior thermal and oxidative stability when compared to typical Type II, 5 Centistoke oils. To make sure that there is no confusion regarding the term "Third Generation", P&WC consider approved "Third Generation" lubricants, only those listed in Table 13.

(3) Other Oils

(a) No other oils are approved for use in PW300 engines. Should the use of an oil not listed be desired, the intended user should contact Pratt & Whitney Canada, Product Support Department for consultation.

TABLE 12, Approved Lubricating Oils - PWA521, Type II (5 Centistokes)

Brand	Supplier
Aero Shell Turbine Oil 500 Royco Turbine Oil 500	Royal Lubricants Co. Inc. P.O. Box 518 Hanover, NJ 17936 USA Shell Canada Products Ltd. 1500 Don Mills Road Don Mills, Ontario Canada M3B 3K4 Shell International Petroleum Co. Shell Center London, SEI 7NA England

TABLE 12, Approved Lubricating Oils - PWA521, Type II (5 Centistokes) (Cont'd)

Brand	Supplier
Mobil Jet Oil II	ExxonMobil Corporation 3225 Gallows Rd.. Fairfax VA 22037 USA Tel: 1-800-662-4524 Website: www.exxonmobil.com
Castrol 5000	Castrol Inc. 30 Executive Ave. Edison, NJ 08817 USA Castrol Canada Inc. 3660 Lakeshore Blvd., West Toronto, Ontario Canada M8W 1P2 Castrol (U.K.) Ltd. Burmah House Pipers Way Swindon, Berkshire SN3 1RE, England
BP Turbo Oil 2380	Air BP BP Exploration & Oil Inc. Maple Plaza II - 1N Six campus Dr. Parsippany NJ 07054-4406 USA Tel: 973-401-4350 Website: www.airbp.com

TABLE 13, Approved Lubricating Oils - PWA521, Type II (5 Centistokes)
"THIRD GENERATION"

Brand	Supplier
Mobil Jet Oil 254	ExxonMobil Corporation 3225 Gallows Rd.. Fairfax VA 22037 USA Tel: 1-800-662-4524 Website: www.exxonmobil.com
Aero Shell Turbine Oil 560	Royal Lubricants Co. Inc. P.O. Box 518 Hanover, NJ 07936 USA

TABLE 13, Approved Lubricating Oils - PWA521, Type II (5 Centistokes)
"THIRD GENERATION" (Cont'd)

Brand	Supplier
	Shell Canada Products Ltd. 1500 Don Mills Road Don Mills, Ontario Canada M3B 3K1
	Shell International Petroleum Co. Shell Centre London, SE1 7NA England

FAULT ISOLATION - 1

1. General

Fault Isolation is divided into four sections, FAULT ISOLATION - 1 through FAULT ISOLATION - 4. Breakdown is as follows:

FAULT ISOLATION - 1: General
FAULT ISOLATION - 2: MFD Codes 1A to 5M
FAULT ISOLATION - 3 (Pre-SB24434/Post-SB24514): MFD Codes AA to WE
FAULT ISOLATION - 4 (Post-SB24434/Pre-SB24514): MFD Codes AB to WE

Refer to FAULT ISOLATION - 1 for air, fuel, oil and ignition related fault isolation procedures. General information, procedures and Line Replaceable Unit (LRU) locations are also contained in this section and are applicable to FAULT ISOLATION - 2, - 3, -4.

2. Abbreviations

Table 101 shows the list of abbreviations used in Fault Isolation.

TABLE 101, List of Abbreviations

Abbreviation	Definition
AGB	Accessory Gearbox
A/D	Analogue to Digital Converter
ADC	Air Data Computer
AMM	Aircraft Maintenance Manual
AOG	Aircraft on Ground
APR	Automatic Power Recovery
ASSY	Assembly
ARINC	Aeronautical Radio Incorporated
ATA	Air Transportation Association
BIT	Binary Digit
BITE	Built-in Test Equipment
BOV	Bleed-off Valve
°C	Degrees Celsius
cc	Cubic Centimeters
CCW	Counterclockwise
CG	Center of Gravity
CL	Class
CPU	Central Processing Unit
CW	Clockwise
D/A	Digital to Analogue Converter
Dia.	Diameter

TABLE 101, List of Abbreviations (Cont'd)

Abbreviation	Definition
Dim.	Dimension
ECS	Environment Control System
EDU	Engine Diagnostic Unit
EEC	Electronic Engine Control
EEROM	Electrically Erasable Read Only Memory
EGT	Exhaust Gas Temperature
EICAS	Engine Indicating and Crew Alerting System
F & C	Fits and Clearances
°F	Degrees Fahrenheit
FADEC	Full Authority Digital Electronic Control
Fig.	Figure
FI	Flight Idle
FIR	Full Indicator Reading
FOD	Foreign Object Damage
Fwd.	Forward
GI	Ground Idle
HMU	Hydromechanical Metering Unit or Hydromechanical Fuel Control Unit
HP	High Pressure
HPC	High Pressure Compressor
HPT	High Pressure Turbine
hr.	Hour
HSI	Hot Section Inspection
H/W	Hardware
ID	Inside Diameter
IGV	Inlet Guide Vane
in.	Inch
IPC	*Illustrated Parts Catalog*
kg	Kilogram
kPa	Kilopascals
lb.	Pound
lb.in.	Pound-inch
LE	Leading Edge

TABLE 101, List of Abbreviations (Cont'd)

Abbreviation	Definition
LFV	Lane Failure Value
LH	Left Hand
LP	Low Pressure
LRU	Line Replaceable Unit
LVDT	Linear Variable Differential Transformer
Max.	Maximum
MFD	Multi Function Display
Min.	Minimum
mm	Millimeter
MOP	Main Oil Pressure
MOT	Main Oil Temperature
msec.	Millisecond
N1	Low-pressure Rotor Speed
N1R	Low-pressure Rotor Remote Speed
N2	High-pressure Rotor Speed
N2R	High-pressure Rotor Remote Speed
N	Newton
Nm	Newton-meter
O/C	Open Circuit
OD	Outside Diameter
O/H	Overhaul
O/S	Overspeed
oz.	Ounce
P1	Fan Inlet Pressure
P2.5	Compressor Interstage (3rd & 4th) Discharge Pressure
P2.8	Impeller Inlet Pressure
P3	Compressor Discharge Pressure
Pamb or PAMB	Ambient Engine Inlet Pressure
PAV	Pressure Adjusting Valve
P/N	Part Number
PMA	Permanent Magnet Alternator
psi	Pounds per Square Inch

TABLE 101, List of Abbreviations (Cont'd)

Abbreviation	Definition
psia	Pounds per Square Inch (absolute)
psid	Pounds per Square Inch (differential)
psig	Pounds per Square Inch (gage)
Pt or PT	Engine Inlet Total Pressure
PWC	Pratt and Whitney Canada
RAM	Random Access Memory
Ref.	Reference
RH	Right Hand
ROM	Read Only Memory
rpm	Revolutions per Minute
RVDT	Rotary Variable Differential Transformer
SB	Service Bulletin
S/C	Short Circuit
sec.	Second
SG	Specific Gravity
SOV	Shut-off Valve
S/W	Software
T4.5	Inter-turbine Temperature
tamb	Ambient Temperature
TBA	To Be Advised
TBD	To Be Determined
TBO	Time Before Overhaul
TDC	Top Dead Center
Temp	Temperature
TLA	Throttle Lever Angle
TLD	Time Limited Dispatch
T/R	Thrust Reverser
TTO	Engine Inlet Total Temperature
UART	Universal Asynchronous Receiver and Transmitter
UOS	Unless Otherwise Specified
V	Volt
VIGV	Variable Inlet Guide Vane
1VS	First-stage Variable Stator

TABLE 101, List of Abbreviations (Cont'd)

Abbreviation	Definition
W	Watt
W/D	Watch Dog
WF or Wf	Fuel Flow
WOW	Weight on Wheels

3. Fault Isolation Figures

A. List of Figures

(1) Table 102 lists all Figures for Starting Problems.

(2) Table 103 lists all Figures for Operating Problems.

(3) Table 104 lists all Figures for Lubrication Problems.

TABLE 102, Starting Problems - List of Figures

Figure Title	Figure No.
No Light Up	103
Hot Start	104
Low Motoring Speed	105
No N2 Motoring Speed	106
Hung Start	107
No N1 Speed During Start	108
Start Discrete Functional Check	109

TABLE 103, Operating Problems - List of Figures

Figure Title	Figure No.
Slow to Accelerate	110
Engine Surges	111
Engine Flames - Out	112
Engine Vibration	113
Decrease in Normal T45 Temperature	114
Increase in Normal T45 Temperature	115
Engine Overspeed	116
Incorrect Fuel Flow	117
Fuel Filter Bypass Indication	118
N1 or N2 Instability	119
Incorrect N1 Indication	120

TABLE 103, Operating Problems - List of Figures (Cont'd)

Figure Title	Figure No.
FADEC Fault Light with no Applicable MFD Code	121
External Engine Fuel System Leaks	122
Engines Do not Sync	123
No Anti-ice Valve Indication	124
No N2 Speed Indication on Cockpit Gauge	125
No T45 or MFD Code Indication	126
Oil Smell or Smoke in the Cabin	127
Engine Performance Deterioration	128

TABLE 104, Lubrication Problems - List of Figures

Figure Title	Figure No.
High Oil Temperature	129
Low Oil Pressure	130
Fluctuating Oil Pressure	131
High Oil Pressure	132
Black/Discolored Oil	133
High Oil Consumption	135
Oil Leak from No. 4 Bearing Area or Smoke Out of Tail Pipe	136
Static Oil Leak from AGB Overboard Drains	137
Oil Filter Bypass Indication	138
Chip Detector Indication	139
Debris in Oil	140

4. "P" and "J" Connector Locations

A. Description

(1) Table 105 shows connector numbers and their related end devices.

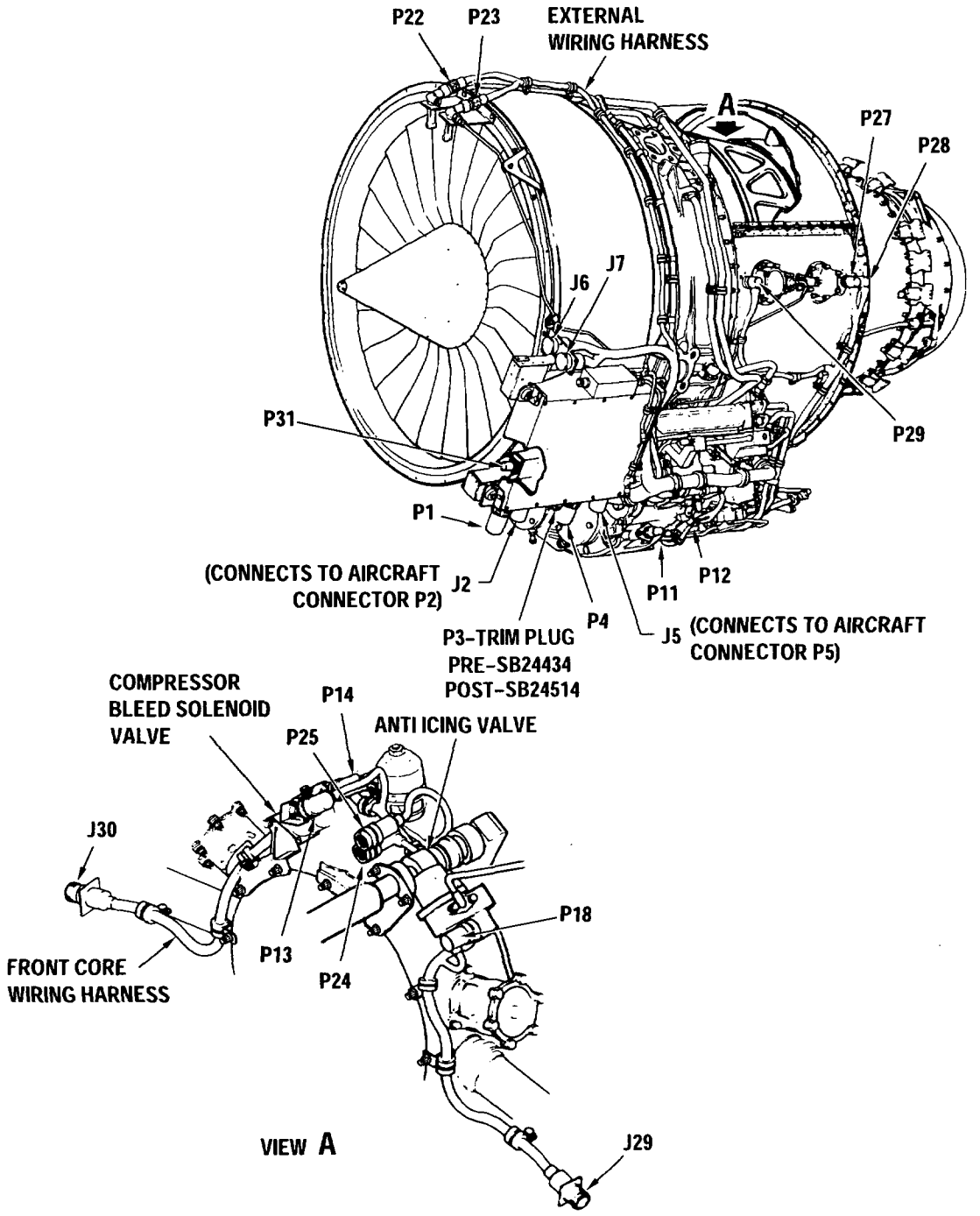
(2) Figure 101 shows connector locations on the engine.

TABLE 105, "P" and "J" Connector Locations

Connector	End Device
P1	EEC - CH. A
P2	EEC Airframe Connector CH A

TABLE 105, "P" and "J" Connector Locations (Cont'd)

Connector	End Device
P4	EEC - CH. B
P5	EEC Airframe Connector CH B
P9	N2 Sensor - CH. A
P10	N2 Sensor - CH. B
P11	PMA - CH. A
P12	PMA - CH. B
P13	Compressor Bleed Valve Solenoid - CH. A
P14	Compressor Bleed Valve Solenoid - CH. B
P15	HMU - CH. A
P16	HMU - CH. B
P17	HMU - Standby Shutdown
P18	Anti-ice Solenoid Valve
P22	T1 Sensor - CH. B
P23	T1 Sensor - CH. A
P24	IGV Actuator - CH. B
P25	IGV Actuator - CH. A
P27	Rear Core Harness - CH. A
P28	Rear Core Harness - CH. B
P29	Front Core Harness - CH. A
P30	Front Core Harness - CH. B
P31	N1 Trim Plug
P34	Start Valve - CH. A and B
P39	P3 Transducer (Post-SB24434/ Pre-SB24514)
J3	Trim Plug Receptacle
J6	Airframe Connector - CH. B
J7	Airframe Connector - CH. A
J27	Rear Core Harness - CH. A
J28	Rear Core Harness - CH. B
J29	Front Core Harness - CH. A
J30	Front Core Harness - CH. B



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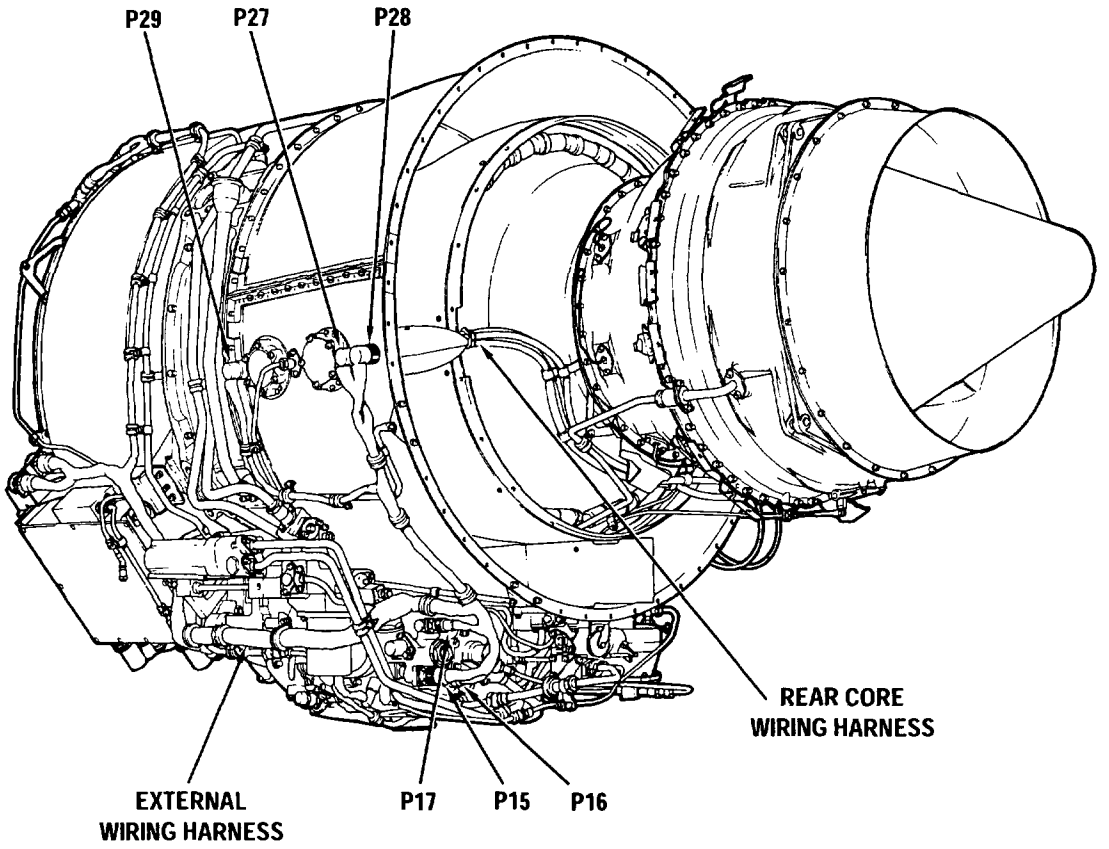
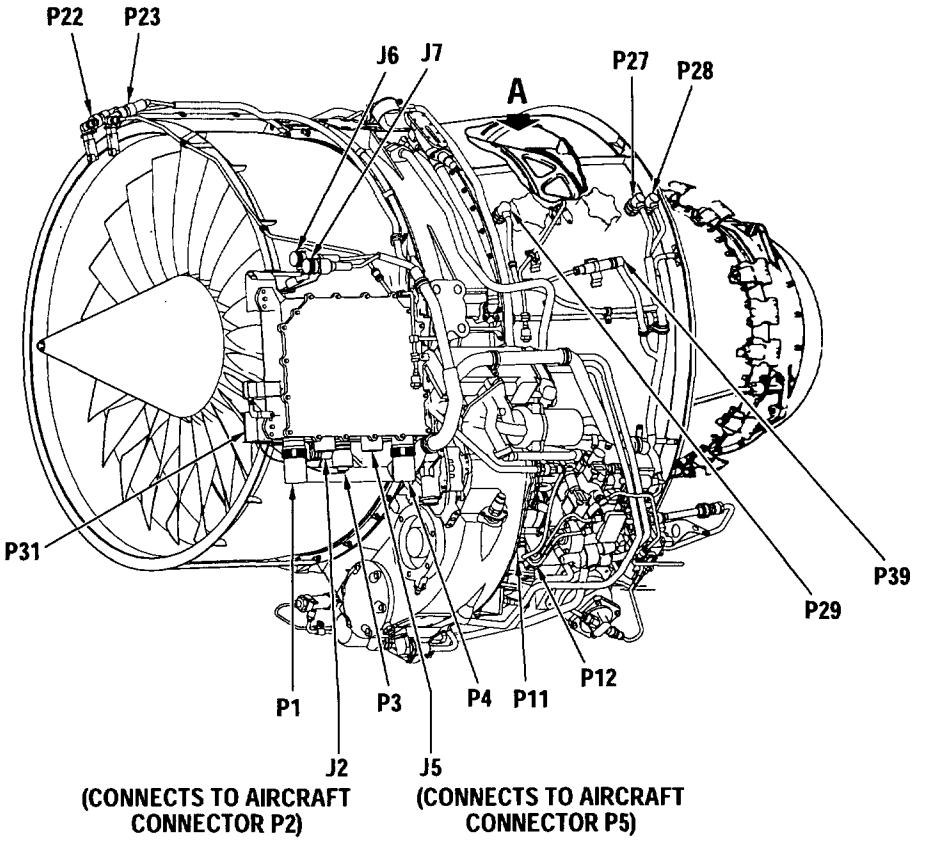
"P" and "J" Connector Locations
Figure 101 (Sheet 1 of 5)



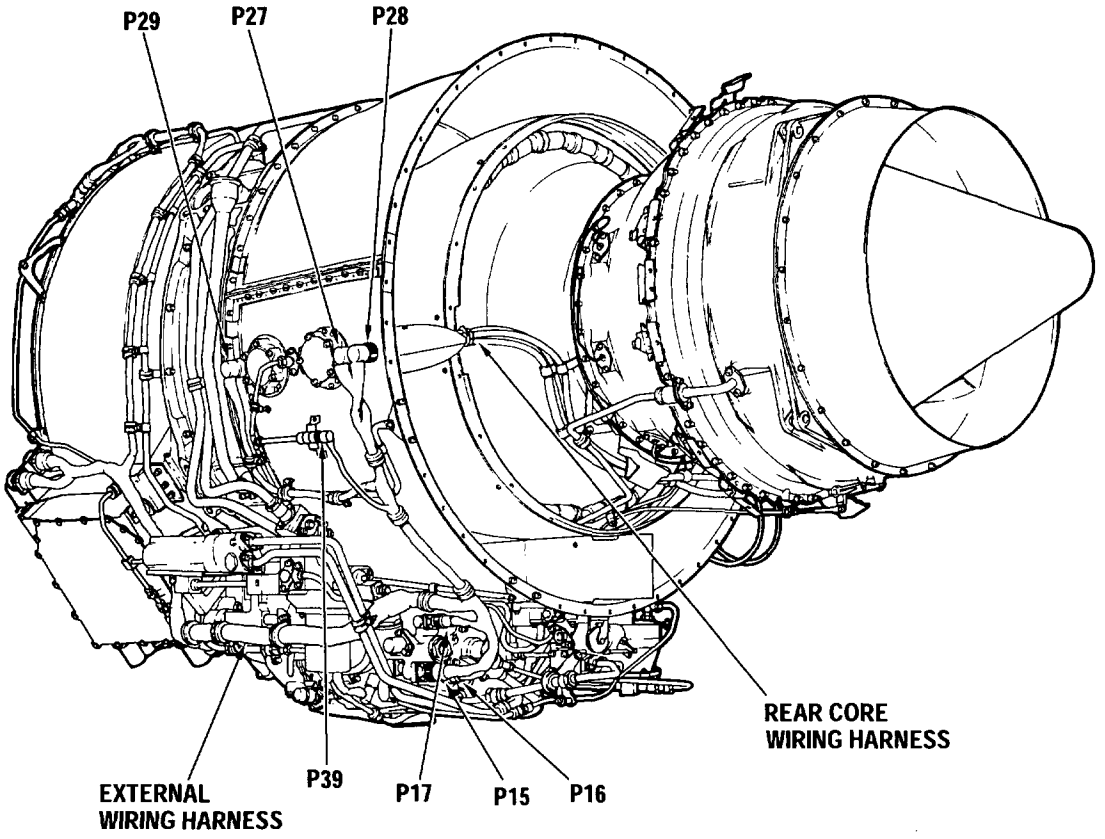
I **Pre-SB24434/Post-SB24514** C19841

"P" and "J" Connector Locations
Figure 101 (Sheet 2)



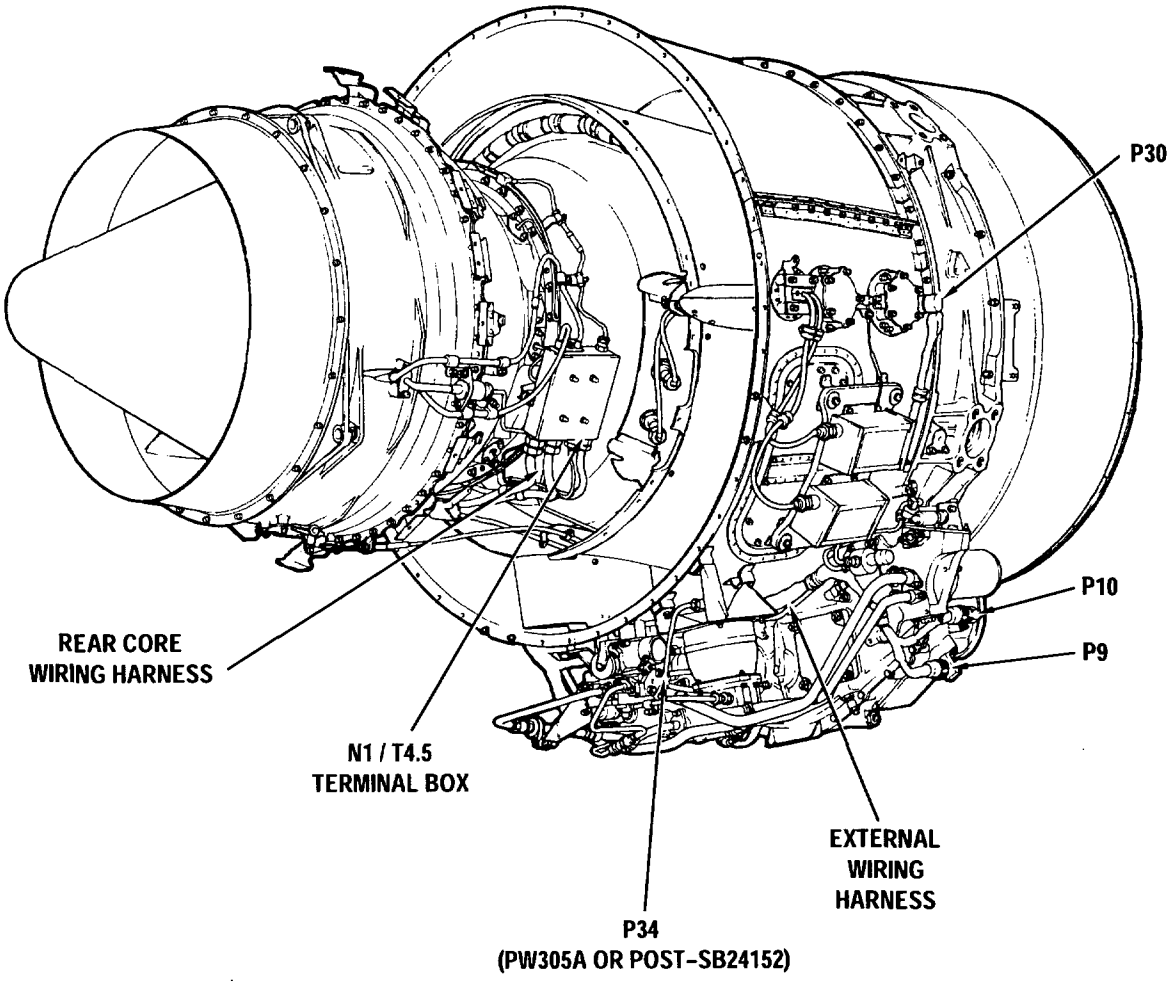
C62097A

"P" and "J" Connector Locations
Figure 101 (Sheet 3)



I **Post-SB24434/Pre-SB24514** C39408

"P" and "J" Connector Locations
Figure 101 (Sheet 4)



C19840A

"P" and "J" Connector Locations
Figure 101 (Sheet 5)

5. Line Replaceable Units (LRUs) and Check/Servicing Procedures

A. Description

(1) Table 106 lists the location in the Maintenance Manual of LRUs referenced in the fault isolation figures.

TABLE 106, LRU to Maintenance Manual Cross Reference

LRU	Chapter
AGB and Oil Seals	72-60-01
AGB Breather Orifice (Square Drive Adapter)	72-60-01
Anti-ice Solenoid Valve	75-10-01
Bypass Ducts	72-70-01
Chip Detector	72-00-00
Cold Start Valve	72-60-01
Compressor Bleed Valves	75-30-01
BOV Solenoid	75-30-02
EEC	73-20-02
Fan	72-30-01
Fuel Waste Ejector	73-10-03
Fuel Manifold and Nozzles	73-10-04
Fuel Shut-off Valve	73-10-05
Fuel Dump Valve	73-10-05
Fuel Filter	73-10-03
Fuel Pressure Tubes	73-10-01
Fuel Pump	73-10-02
Fuel/Oil Heat Exchanger	79-20-02
HMU	73-20-01
Igniters	74-10-01
Ignition Exciters	74-10-01
Ignition Cables	74-10-01
N1 and N2 Speed Sensors	77-10-01
N1/T4.5 Terminal Box	77-20-01
Oil Pressure Adjusting Valve	79-20-01
Oil Pressure Tubes	79-20-04
Oil Scavenge Tubes	79-20-03
Oil Filter	79-20-01
Oil Pressure Measuring System	79-30-02
Oil Pump	79-20-05

TABLE 106, LRU to Maintenance Manual Cross Reference (Cont'd)

LRU	Chapter
Over-pressure "Pop-up" Indicator	79-30-03
P1/T1 Sensors	77-20-02
P3 Air Tubes	75-30-03
Rotary Stator Vane Actuator	75-30-04
T4.5 Thermocouple Wiring Hamess	77-20-01
Wiring Harnesses	73-20-03
CHECK/SERVICING PROCEDURES	
AGB Scavenge Pump Strainer	72-00-00
Borescope HPC4 and HPT1	72-00-00
Ignition Check	74-10-01
Oil Servicing	72-00-00

6. MFD Code Summary

A. Description

(1) Table 107 and (1) provides MFD Codes and their related Faults.

TABLE 107, MFD Code Summary (Pre-SB24434/Post-SB24514)

MFD Code	Fault
1A	Software Fail
1B	Processor Fail
1C	ROM Fail
1D	RAM Fail
1E	Spurious Interrupt
1F	Watchdog Failed to Reset Processor
1G	S/W not Executing Regularly
1H	Task Over-run
1J	Parity Check
2A	Watchdog Caused Processor Reset
2B	(Not used)
2C	(Not used)
2D	BITE Circuit
2E	A/D Fault
2F	T45 Cold Junction
2G	Other Lane Health
2H	EEROM Fail
2J	ARINC Transmit

TABLE 107, MFD Code Summary (Pre-SB24434/Post-SB24514) (Cont'd)

MFD Code	Fault
2K	EEC Over-temperature
2L	EEROM Software Trims Checksum Fail
3A	Overspeed Drive
3B	Overspeed Start-up
3C	Overspeed Shutdown
4A	Software Lane Disconnect
4B	Software Lane Test Disconnect
4C	Lane Connected Status Fail
4D	Latency Fault
4E	Watchdog Unable to Disconnect Lane
5A	APR (ATTCS) Armed Relay O/C
5B	APR (ATTCS) Armed Relay S/C
5C	APR (ATTCS) Achieved Relay O/C
5D	APR (ATTCS) Achieved Relay S/C
5E	Soft Fail 1 Drive O/C
5F	Soft Fail 1 Drive S/C
5G	Soft Fail 2 Drive O/C
5H	Soft Fail 2 Drive S/C
5J	(Not used)
5K	(Not used)
5L	Igniter Drive O/C
5M	Igniter Drive S/C
AA	Wf Input Interface
AB	Wf Input Rate or Range
AC	Wf Driver
AD	Wf Control Loop
AE	IGV Driver
AF	IGV Control Loop
AG	Metering Valve not Closed
AH	IGV Track Check - Steady State
BA	IGV Input Interface
BB	IGV Rate or Range
CA	BOV Drive O/C (External)
CB	BOV Drive O/C (Internal)
CC	BOV Drive S/C (Internal)
CD	BOV Bite Fault (Post-SB24274)

TABLE 107, MFD Code Summary (Pre-SB24434/Post-SB24514) (Cont'd)

MFD Code	Fault
DA	N1 Input Interface
DB	N1 Rate or Range
EA	N2 Input Interface
EB	N2 Rate or Range
FA	T45 Input Interface
FB	T45 Rate or Range
GA	P3 Input Interface
GB	P3 Range
HA	EEC Pt Input Interface
HB	EEC Pt Rate or Range
JA	EEC Pamb Input Interface
JB	EEC Pamb Rate or Range
KA	TT0 Input Interface
KB	TT0 Rate or Range
LA	PMA Voltage Fault
LB	Aircraft Disconnect
MA	Invalid Trim Plug State
MB	Invalid EEROM Trim Plug Image
MC	Trim Plug not the Same as EEROM Image
MD	Engine/EEC Standards Incompatible
NC	Engine Light Fail
ND	T45 Start Limit Exceeded
PA	N1R Input Interface
PB	N1R Rate or Range
PC	N2R Input Interface
PD	N2R Rate or Range
QA	TLA Input Interface
QB	TLA Rate or Range
QC	TLA Rigging or Range Input Fault (PW305B only)(Post-SB24337)
QD	TLA in Cut-off Inconsistency (PW305B only)(Post-SB24337)
QE	Commanded Shutdown in Air (PW305B only) (Post-SB24337)
RA	ARINC Receive
RB	ADC Pt, Range or in Range Fail

TABLE 107, MFD Code Summary (Pre-SB24434/Post-SB24514) (Cont'd)

MFD Code	Fault
RC	ADC Pamb, Range or in Range Fail
RD	ADC TT0, Range or in Range Fail
SA	WOW Discrete Check
SB	Not used
TA	T/R Discretes Sequence Check
TB	T/R Spurious Discrete
TC	Auto Stow Discrete Input Fault
TD	Thrust Reverser Discrete Fault
TE	Engine Speed Limited at Idle when in Transit Discrete Set
UA	Not used
UB	Not used
UC	Not used
UD	Not used
UE	Not used
UF	Not used
UG	ATTCS Achieved BITE Fault
UH	ATTCS Armed BITE Fault
UJ	Soft Fail 1 BITE Fault
UK	Soft Fail 2 BITE Fault
UL	Ignition Drive BITE Fault
VA	External Reset Discrete Input Fault (PW305A only)
VB	Channel Inhibit Discrete Input Fault (PW305A only)
VC	Channel Inhibited in Air (PW305A only)
VD	Flap Discrete Input Fault (PW305A only)
VE	Channel Inhibit Ground Fault (PW305A only)
VF	Aircraft Identification Fault
WA	Start Valve Drive External Open Circuit
WB	Start Valve Drive Internal Open Circuit
WC	Start Valve Drive External Short Circuit
WD	Start Valve not Fitted but Detected
WE	Start Valve Drive BITE Fault

TABLE 108, MFD Code Summary (Post-SB24434/Pre-SB24514)

MFD Code	Fault
2D	BITE Circuit
2E	A/D Fault
2F	T45 Cold Junction
2G	Other Lane Health
2H	EEROM Fail
2J	ARINC Transmit
2K	EEC Over-temperature
3A	Overspeed Drive
3B	Overspeed Start-up
3C	Overspeed Shutdown
4A	Software Lane Disconnect
4B	Software Lane Test Disconnect
4C	Lane Connected Status Fail
4D	Latency Fault
5A	APR (ATTCS) Armed Relay O/C
5B	APR (ATTCS) Armed Relay S/C
5C	APR (ATTCS) Achieved Relay O/C
5D	APR (ATTCS) Achieved Relay S/C
5E	Soft Fail 1 Drive O/C
5F	Soft Fail 1 Drive S/C
5G	Soft Fail 2 Drive O/C
5H	Soft Fail 2 Drive S/C
5L	Igniter Drive O/C
5M	Igniter Drive S/C
AB	Wf Input Rate or Range
AC	Wf Driver
AD	Wf Control Loop
AE	IGV Driver
AF	IGV Control Loop
AG	Metering Valve not Closed
AH	IGV Track Check - Steady State
BB	IGV Rate or Range
CB	BOV Drive O/C (Internal)
CC	BOV Drive S/C (Internal) or External Open Circuit
CD	BOV Bite Fault
DB	N1 Rate or Range

TABLE 108, MFD Code Summary (Post-SB24434/Pre-SB24514) (Cont'd)

MFD Code	Fault
EB	N2 Rate or Range
FB	T45 Rate or Range
GB	P3 Range
HB	EEC Pt Rate or Range
JB	EEC Pamb Rate or Range
KB	TT0 Rate or Range
LA	PMA Voltage Fault
LB	Loss of Aircraft Power when Running on PMA
MA	Invalid Trim Plug State
MB	Invalid EEROM Trim Plug Image
MC	Trim Plug not the Same as EEROM Image
MD	Engine/EEC Standards Incompatible
NC	Engine Light Fail
ND	T45 Start Limit Exceeded
PB	N1R Rate or Range
PD	N2R Rate or Range
QB	TLA Rate or Range
QC	TLA Rigging or Range Input Fault (PW305B only)
QD	TLA in Cut-off Inconsistency (PW305B only)
QE	Commanded Shutdown in Air (PW305B only)
QF	Uncommanded Shutdown (PW305A only)
RA	ARINC Receive
RB	ADC Pt, Range or in Range Fail
RC	ADC Pamb, Range or in Range Fail
RD	ADC TT0, Range or in Range Fail
SA	WOW Discrete Check
TA	T/R Discretes Sequence Check
TB	T/R Spurious Discrete
TC	Auto Stow Discrete Input Fault
TD	Thrust Reverser Discrete Fault
TE	Engine Speed Limited at Idle when in Transit Discrete Set

TABLE 108, MFD Code Summary (Post-SB24434/Pre-SB24514) (Cont'd)

MFD Code	Fault
VB	Channel Inhibit Discrete Input Fault (PW305A only)
VC	Channel Inhibited in Air (PW305A only)
VD	Flap Discrete Input Fault (PW305A only)
VE	Channel Inhibit Ground Fault (PW305A only)
VF	Aircraft Identification Fault
WB	Start Valve Drive Internal Open Circuit
WC	Start Valve Drive External Short Circuit or External Open Circuit
WD	Start Valve not Fitted but Detected
WE	Start Valve Drive Bite Fault

7. Electronic Engine Control (EEC)

A. Procedure

CAUTION: SWITCH OFF EEC ELECTRICAL POWER AND SWITCH ON MAINTENANCE TEST DISCRETE (REF. A.M.M.) BEFORE REMOVING OR INSTALLING ANY ELECTRICAL CONNECTOR

(1) All EEC fault isolation and corrective action procedures are to be done with the aircraft on the ground only.

(2) All resistance values contained within the corrective action procedures are defined to cover an ambient temperature range of –55°C to +80°C.

(3) The resistance of an electrical circuit varies directly as a function of temperature. If a high resistance value is measured for a cold component on a cold day, but is acceptable according to the Fault Isolation Table, it is possible that when the engine is hot, the component resistance will be high enough to cause a fault.

(4) Inspect pin and socket ends for corrosion, contamination or damage when connectors are removed.

(5) All recycling of EEC 28 VDC aircraft power is required with engine(s) not running.

(6) Clean electrical connectors using trichloroethane.

(7) Do all chromel and alumel thermocouple harness checks as follows:

(a) Positive test lead to positive lead lug.

(b) Negative test lead to negative lead lug.

(c) Record resistance value (ie 9.8 ohms).

(d) Negative test lead to positive lead lug.

(e) Positive test lead to negative lead lug.

(f) Record resistance value (ie 23.0 ohms).

(g) Use average resistance value. ie.

Overall resistance value = $\frac{23.0 + 9.8}{2}$ = 16.4 ohms.

(8) All EEC fault isolation and corrective action procedures are based on treating each fault as a single fault occurrence.

(9) An EEC intermittent fault is a fault which occurs more than once for every two flight legs.

(10) For flight legs with more than one fault occurrence, troubleshoot faults with numerically prefixed MFD fault codes first.

(11) If multiple fault codes occur, check for loose or dirty electrical connectors and rectify as required. Check if fault codes have cleared before proceeding with EEC removal.

8. Multifunction Display (MFD) Logic Requirements (Post-SB24083)

A. Procedure

(1) Every EEC fault which produces a cockpit indication can be annunciated via the EEC ARINC 429-11 data bus.

(2) A single EEC fault will produce 1 MFD code.

(3) Table 109 lists MFD codes that do not produce a cockpit indication.

TABLE 109, MFD Codes With No Cockpit Indication

MFD Code	Fault
HA	EEC Pt Input Interface
HB	EEC Pt Rate or Range
JA	EEC Pamb Input Interface
JB	EEC Pamb Rate or Range
KA	TTO Input Interface
KB	TTO Rate or Range
LB	Loss of Acft 28V when Power is from PMA (Post-SB24434/Pre-SB24514)
QF	Uncommanded Shutdown (Post-SB24434/ Pre-SB24514)
RA	ARINC Receive

TABLE 109, MFD Codes With No Cockpit Indication (Cont'd)

MFD Code	Fault
RB	ADC Pt, Range or In Range Fail
RC	ADC Pamb, Range or in Range Fail
RD	ADC TTO, Range or in Range Fail

9. Full Authority Digital Electronic Control (FADEC) Multifunction Display (MFD)

A. Description (Ref. Fig. 102)

(1) The maintenance codes are transmitted to the MFD in chronological order of fault occurrence and displayed in alpha-numeric character fault codes.

(2) A maximum of six fault codes are displayed per line in the order of their occurrence. Each single fault is displayed once on a line. If the number of fault codes on a line is less than six, the remaining code columns display dash characters followed by spaces.

(3) If more than six faults occur for a given flight leg, the oldest fault is lost. However, if the lost fault is still an on-going failure, the fault will re-appear after EEC 28V airframe power supply is reset or after completion of the next flight leg or performance calibration.

(4) PW305B Only:

(a) Line 2 through Line 11 of the MFDs are in color.

(b) Line 2 is reserved for current latched faults in the EEC's Random Access Memory (RAM).

NOTE: 1. With the maintenance test discrete switch turned on and the aircraft on-ground, the recording of faults to the EEC Read Only Memory (EEROM) is inhibited.

NOTE: 2. RAM latched faults are cleared by EEC 28V airframe power supply reset.

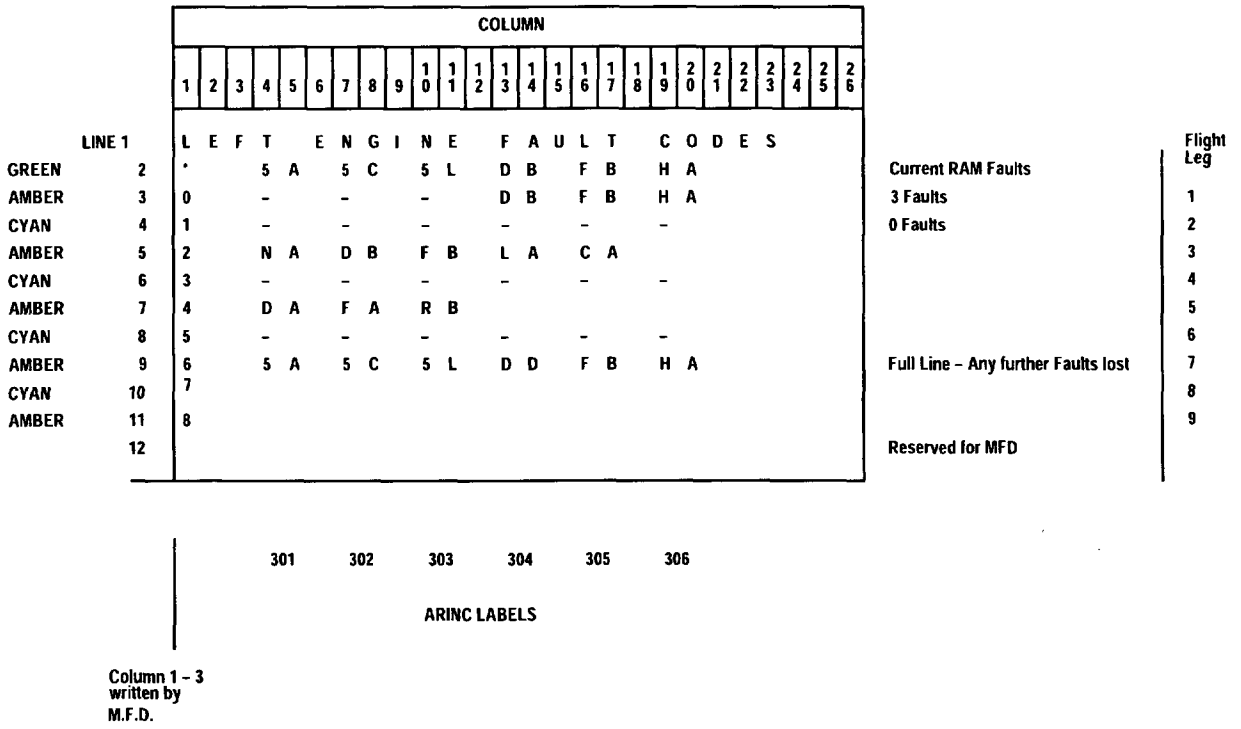
(c) Line 3 will display the current flight leg data as stored in the EEC.

(d) Line 4 through Line 11 will display the previous eight flight legs data, stored as historic faults. Up to six fault codes are recorded in a flight leg.

NOTE: A flight leg is defined as the period between two take-offs with N2 at or above idle.

(e) Data from nine successive flight legs are stored in the EEC. When the MFD is full, data from a new leg will displace data from the oldest flight leg.

FADEC MAINTENANCE DISPLAY WITH MAINTENANCE TEST SWITCH ON


COLUMN
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
LINE 1
L E F T E N G I N E F A U L T C O D E S
GREEN 2 * 5 A 5 C 5 L D B F B H A
AMBER 3 0 - - - D B F B H A
CYAN 4 1 - - - - - -
AMBER 5 2 N A D B F B L A C A
CYAN 6 3 - - - - - -
AMBER 7 4 D A F A R B
CYAN 8 5 - - - - - -
AMBER 9 6 5 A 5 C 5 L D D F B H A
CYAN 10 7
AMBER 11 8
12
Current RAM Faults
3 Faults
0 Faults
Full Line - Any further Faults lost
Reserved for MFD
Flight Leg
1 2 3 4 5 6 7 8 9
301 302 303 304 305 306
ARINC LABELS
Column 1 - 3 written by M.F.D.

PW305B ONLY C32839A

Sample Multi-Function Display (MFD)
Figure 102

10. Fault Levels

A. Description

(1) Fault Level is an indication of the severity of a fault, based on the ability of an EEC channel to provide required system functions. The four levels are listed in Table 110.

TABLE 110, Fault Levels

Fault Level	System Function Availability
0	All system functions are available.
1	Loss of aircraft power disconnect capability. Loss of surge protection/recovery due to P3 fault. Loss of ability to shut-off fuel flow from software. Loss of engine synchronization capability due to any number of faults affecting sync. operation. Loss of ATTCS cockpit indication, armed or achieved driver fault.
2	Cannot guarantee igniter operation from software. Loss of T45 or BOV solenoid control. Loss of ATTCS uptrim function due to any number of failures associated with ATTCS operation.
3	Any number of faults that inhibits the channel from providing thrust in relation to the TLA position or the capability to shut down.

11. Major Code (LRU) Categories (Post-SB24083)

A. Description

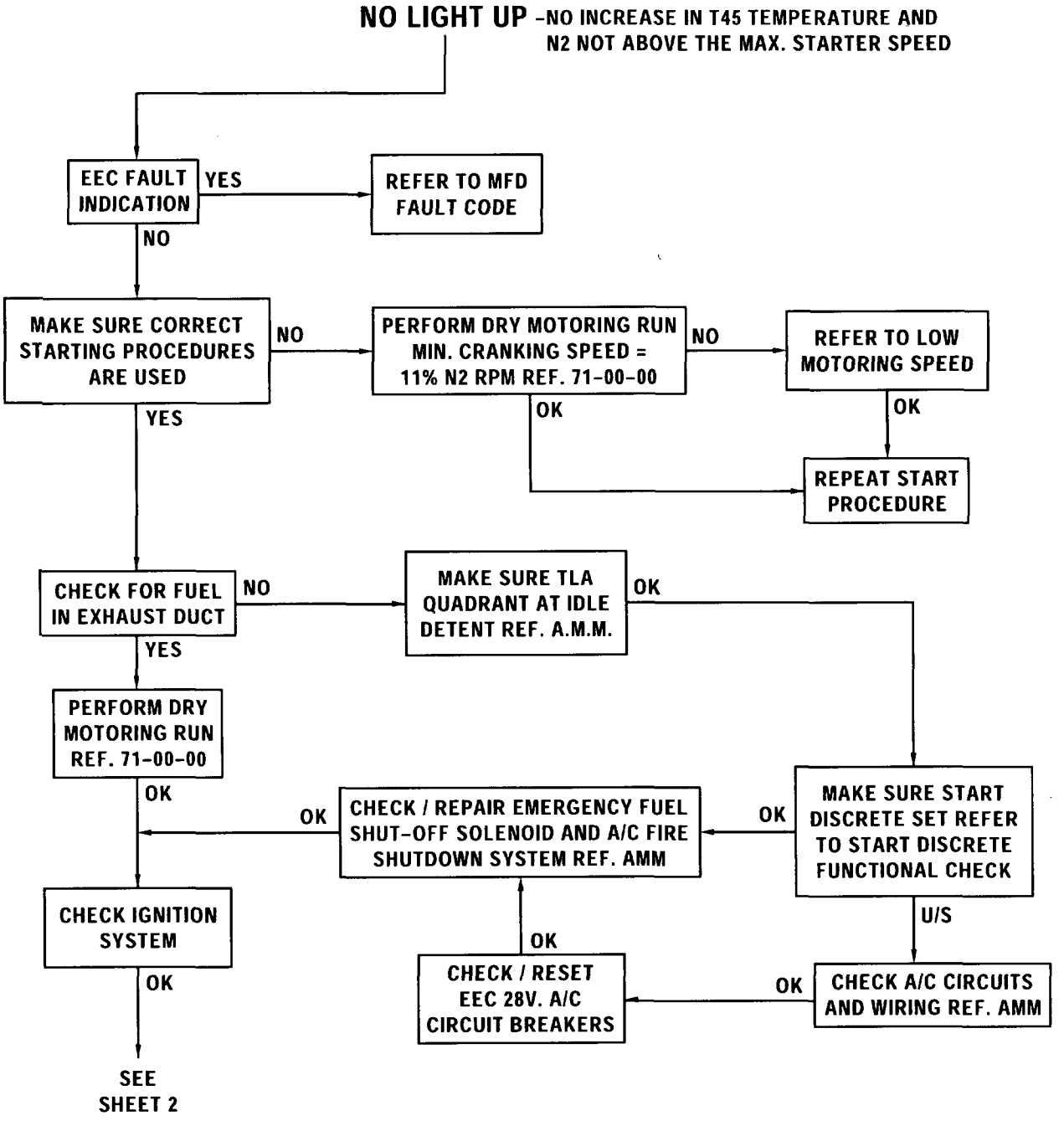
(1) The prefix or first number or letter of each MFD code designation represents a specific LRU. The EEC is designated by LRU codes 1 through 9. Engine interfaces are designated by LRU codes A through N and W. Airframe interfaces are designated by LRU codes P through T and V.

(2) LRU system includes all components which comprise the system, ie: the T45 system includes EEC, main engine harness, rear core harness, junction box and probe harness.

(3) Table 111 lists major code LRU categories.

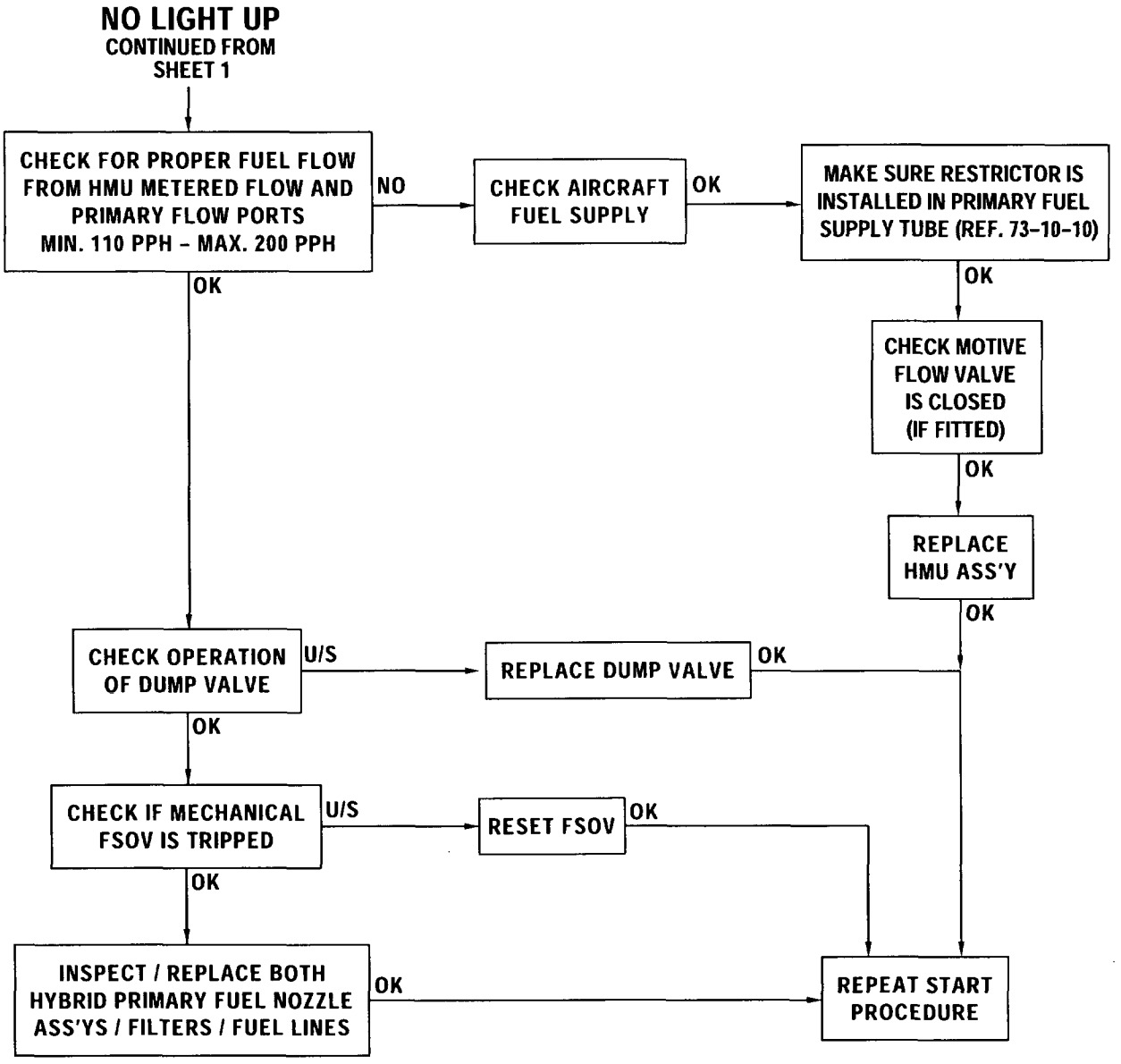
TABLE 111, Major Code LRU Categories

LRU Prefix	LRU Type System Fault
1	EEC internal system hardware/software hard faults. A process reset will occur via a watchdog mis-trigger. Three watchdog mis-triggers will disable the lane.
2	EEC internal system hardware/software faults. These faults will not cause a processor reset but may cause a lane change.
3	EEC Overspeed Hardware System
4	EEC Lane Change System
5	EEC Internal Airframe Relay Interface
A	HMU System
B	IGV Actuator RVDT System
C	BOV System
D	N1 System
E	N2 System
F	T45 System
G	P3 System
H	Pt System
J	Pamb Sensor
K	TTO System
L	PMA System
M	Engine Trim Plug
N	Abort Start Indicators
P	Remote Speed Interface
Q	TLA System
R	ADC ARINC Input System
S	WOW Discrete Input System
T	Thrust Reverser Discrete Inputs System
U	Airframe Relay Interfaces
V	Aircraft Identification
W	Start Valve System


NO LIGHT UP -NO INCREASE IN T45 TEMPERATURE AND N2 NOT ABOVE THE MAX. STARTER SPEED
EEC FAULT INDICATION
YES
REFER TO MFD FAULT CODE
NO
MAKE SURE CORRECT STARTING PROCEDURES ARE USED
NO
PERFORM DRY MOTORING RUN MIN. CRANKING SPEED = 11% N2 RPM REF. 71-00-00
NO
REFER TO LOW MOTORING SPEED
OK
OK
REPEAT START PROCEDURE
YES
CHECK FOR FUEL IN EXHAUST DUCT
NO
MAKE SURE TLA QUADRANT AT IDLE DETENT REF. A.M.M.
OK
YES
PERFORM DRY MOTORING RUN REF. 71-00-00
OK
OK
CHECK / REPAIR EMERGENCY FUEL SHUT-OFF SOLENOID AND A/C FIRE SHUTDOWN SYSTEM REF. AMM
OK
MAKE SURE START DISCRETE SET REFER TO START DISCRETE FUNCTIONAL CHECK
U/S
CHECK IGNITION SYSTEM
OK
OK
CHECK / RESET EEC 28V. A/C CIRCUIT BREAKERS
OK
CHECK A/C CIRCUITS AND WIRING REF. AMM
SEE SHEET 2

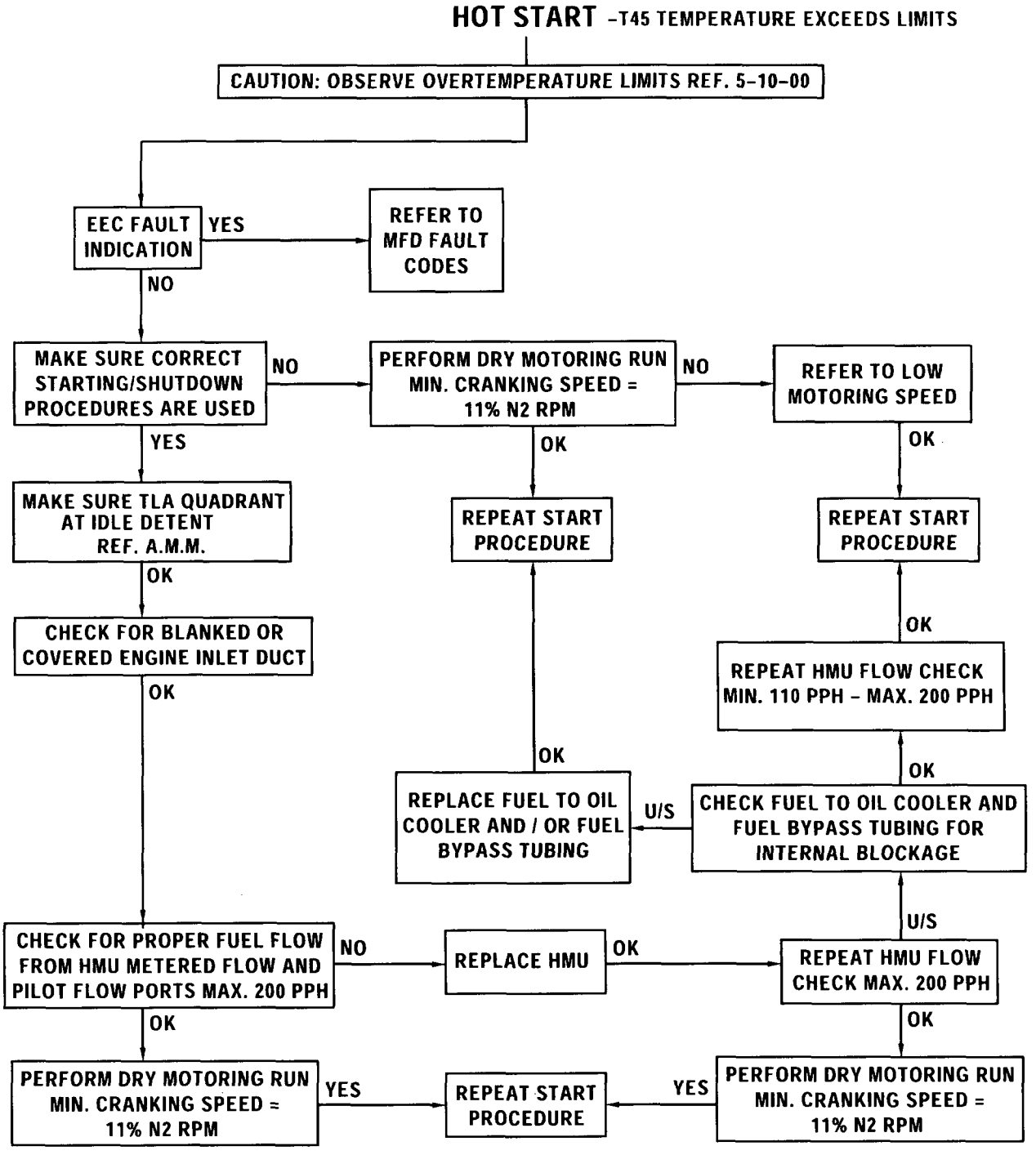
C32170C

Starting Problems - No Light Up
Figure 103 (Sheet 1 of 2)



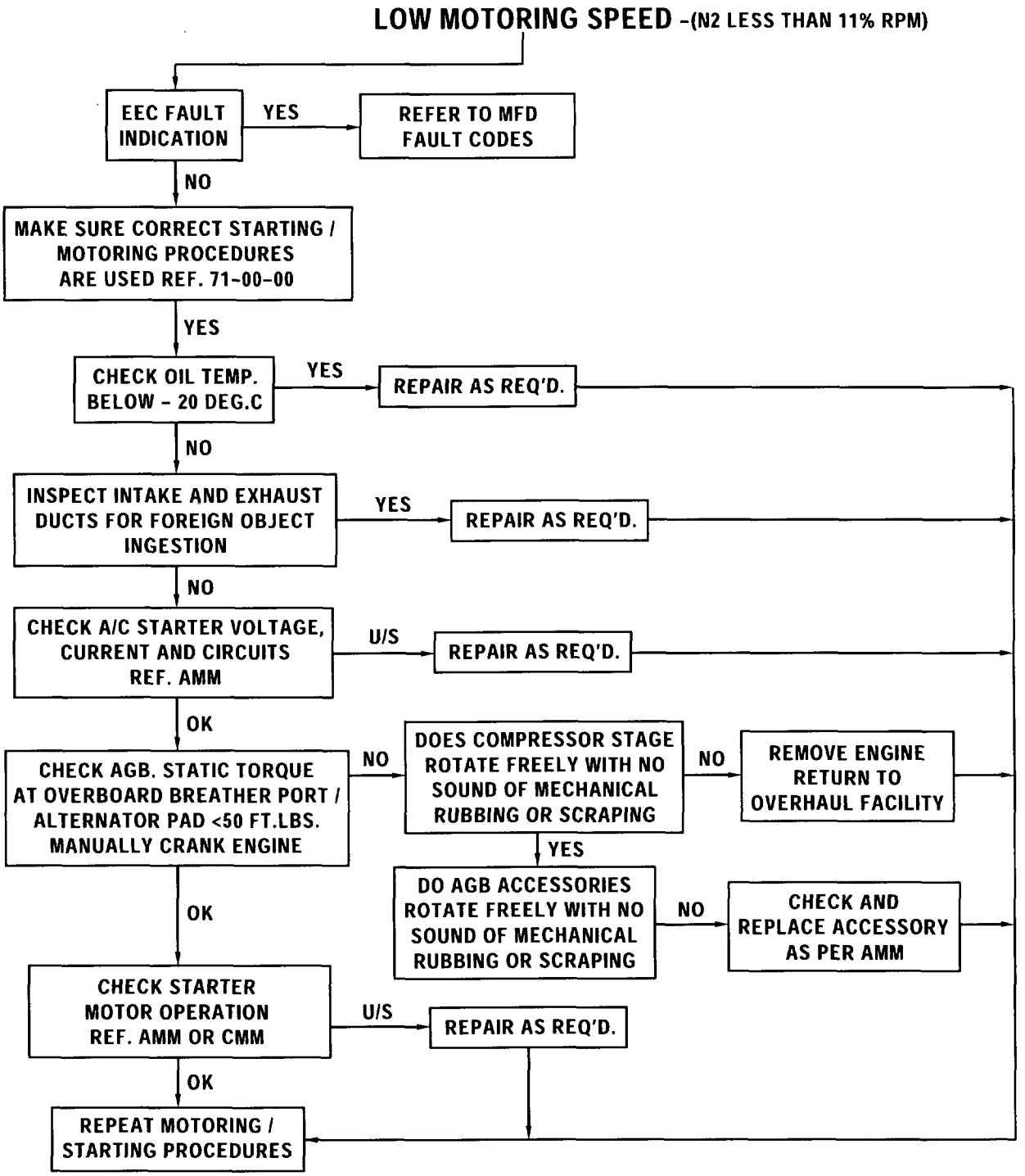
C33827B

Starting Problems - No Light Up
Figure 103 (Sheet 2)


HOT START -T45 TEMPERATURE EXCEEDS LIMITS
CAUTION: OBSERVE OVERTEMPERATURE LIMITS REF. 5-10-00
EEC FAULT INDICATION
YES
REFER TO MFD FAULT CODES
NO
MAKE SURE CORRECT STARTING/SHUTDOWN PROCEDURES ARE USED
NO
PERFORM DRY MOTORING RUN MIN. CRANKING SPEED = 11% N2 RPM
NO
REFER TO LOW MOTORING SPEED
YES
OK
OK
MAKE SURE TLA QUADRANT AT IDLE DETENT REF. A.M.M.
REPEAT START PROCEDURE
REPEAT START PROCEDURE
OK
OK
CHECK FOR BLANKED OR COVERED ENGINE INLET DUCT
REPEAT HMU FLOW CHECK MIN. 110 PPH - MAX. 200 PPH
OK
OK
OK
REPLACE FUEL TO OIL COOLER AND / OR FUEL BYPASS TUBING
U/S
CHECK FUEL TO OIL COOLER AND FUEL BYPASS TUBING FOR INTERNAL BLOCKAGE
U/S
CHECK FOR PROPER FUEL FLOW FROM HMU METERED FLOW AND PILOT FLOW PORTS MAX. 200 PPH
NO
REPLACE HMU
OK
REPEAT HMU FLOW CHECK MAX. 200 PPH
OK
OK
PERFORM DRY MOTORING RUN MIN. CRANKING SPEED = 11% N2 RPM
YES
REPEAT START PROCEDURE
YES
PERFORM DRY MOTORING RUN MIN. CRANKING SPEED = 11% N2 RPM

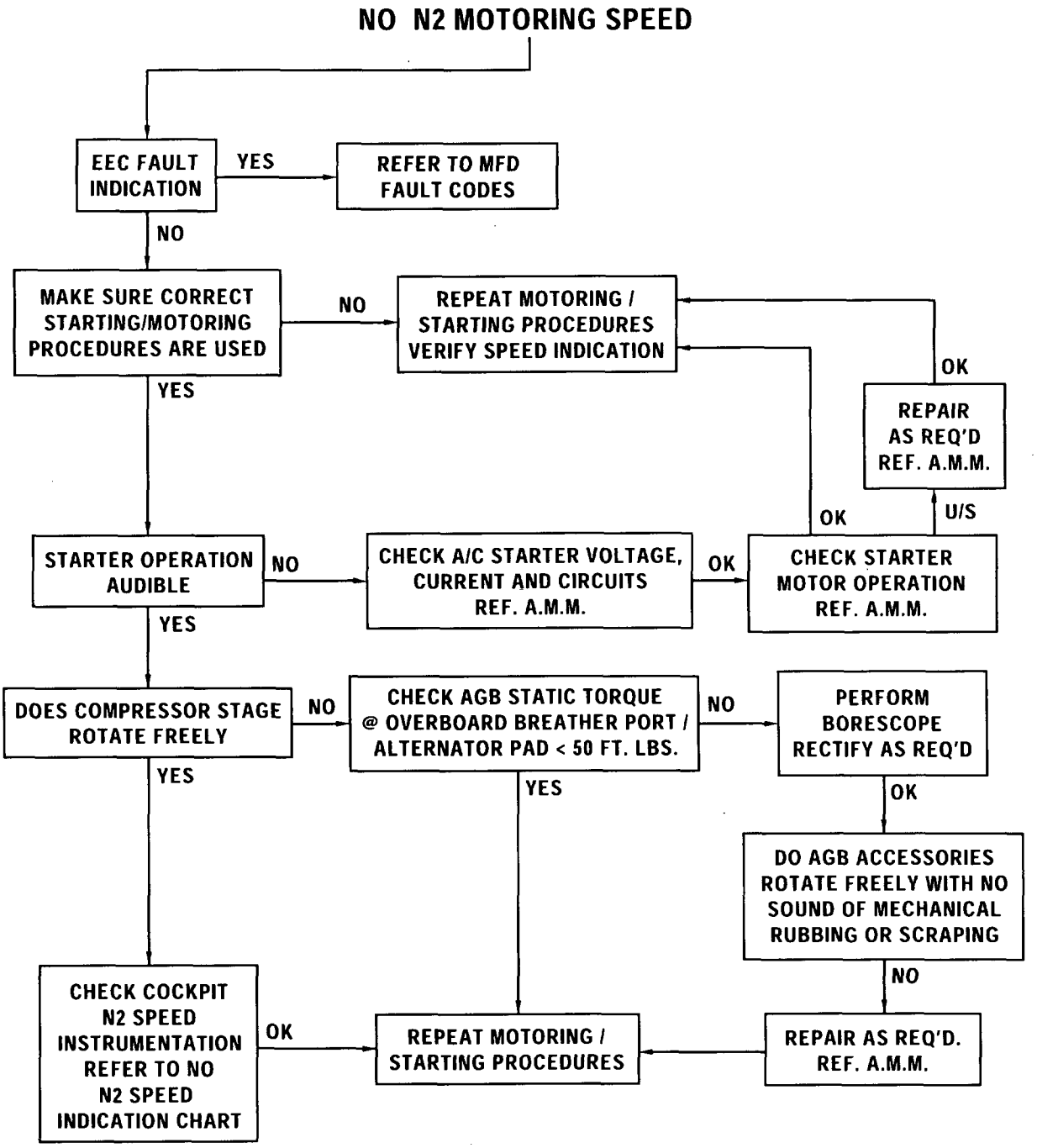
C32169C

Starting Problems - Hot Start
Figure 104


LOW MOTORING SPEED -(N2 LESS THAN 11% RPM)
EEC FAULT INDICATION
YES
REFER TO MFD FAULT CODES
NO
MAKE SURE CORRECT STARTING / MOTORING PROCEDURES ARE USED REF. 71-00-00
YES
CHECK OIL TEMP. BELOW - 20 DEG.C
YES
REPAIR AS REQ'D.
NO
INSPECT INTAKE AND EXHAUST DUCTS FOR FOREIGN OBJECT INGESTION
YES
REPAIR AS REQ'D.
NO
CHECK A/C STARTER VOLTAGE, CURRENT AND CIRCUITS REF. AMM
U/S
REPAIR AS REQ'D.
OK
CHECK AGB. STATIC TORQUE AT OVERBOARD BREATHER PORT / ALTERNATOR PAD <50 FT.LBS. MANUALLY CRANK ENGINE
NO
DOES COMPRESSOR STAGE ROTATE FREELY WITH NO SOUND OF MECHANICAL RUBBING OR SCRAPING
NO
REMOVE ENGINE RETURN TO OVERHAUL FACILITY
YES
DO AGB ACCESSORIES ROTATE FREELY WITH NO SOUND OF MECHANICAL RUBBING OR SCRAPING
NO
CHECK AND REPLACE ACCESSORY AS PER AMM
OK
CHECK STARTER MOTOR OPERATION REF. AMM OR CMM
U/S
REPAIR AS REQ'D.
OK
REPEAT MOTORING / STARTING PROCEDURES

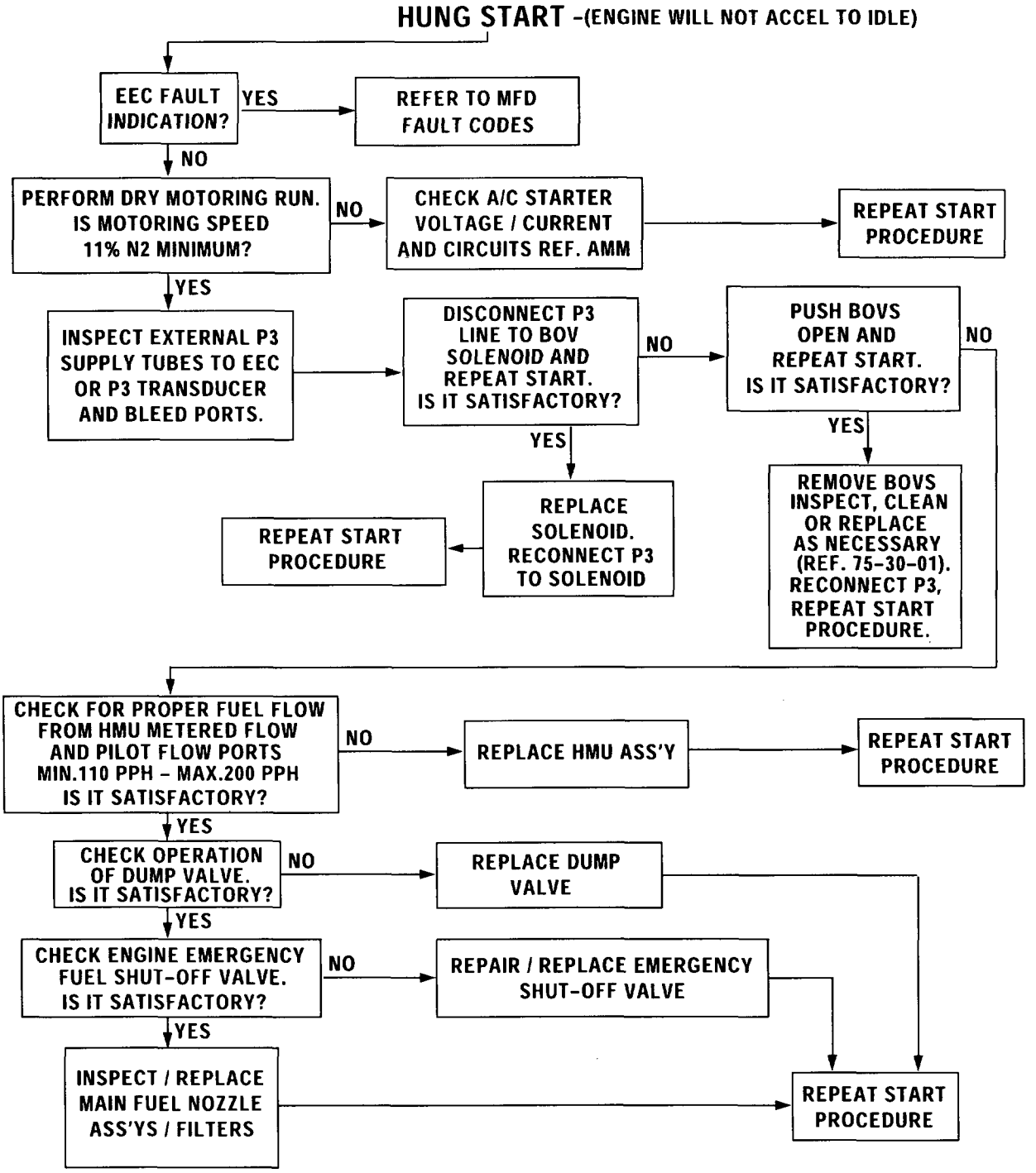
C32168A

Starting Problems - Low Motoring Speed
Figure 105



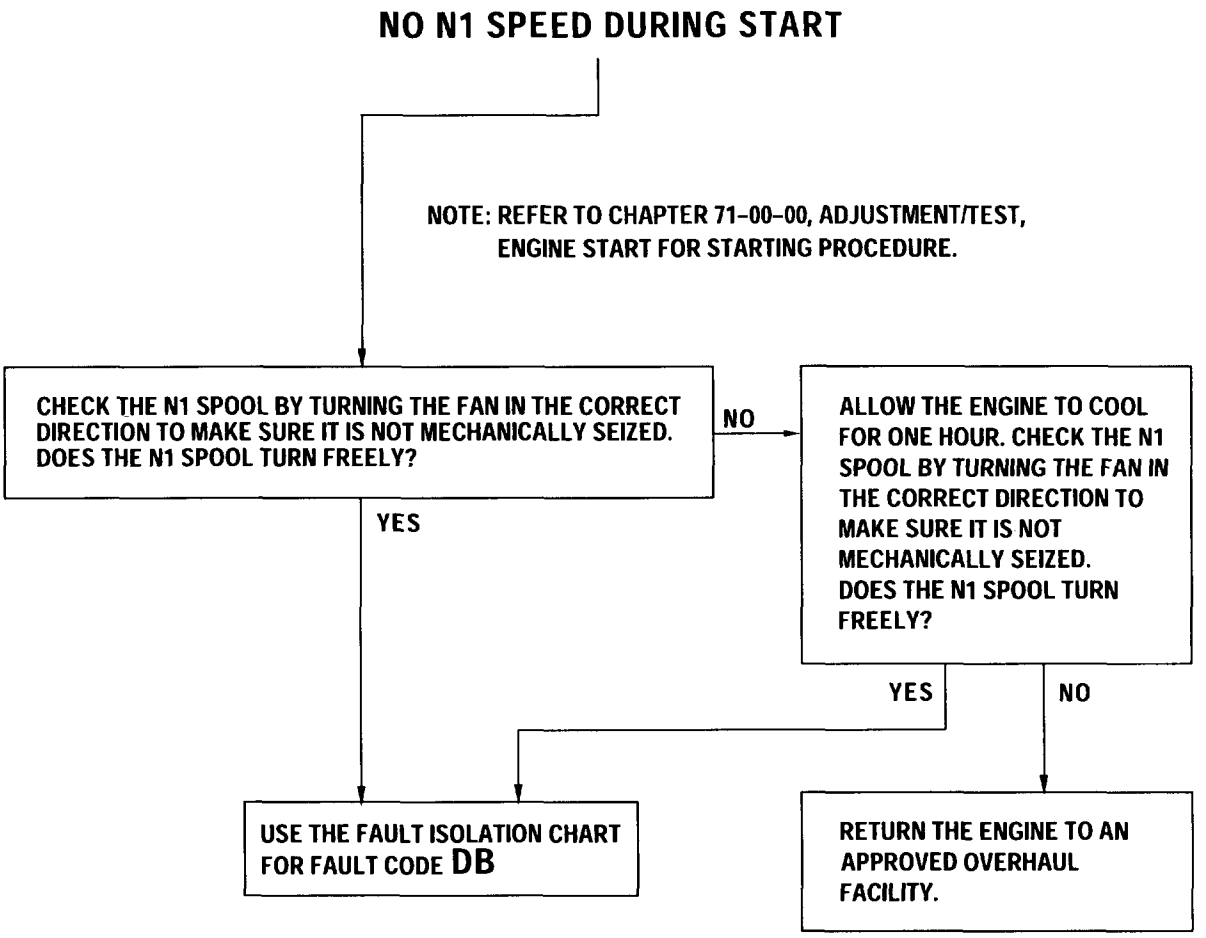
C32167B

Starting Problems - No N2 Motoring Speed
Figure 106


HUNG START -(ENGINE WILL NOT ACCEL TO IDLE)
EEC FAULT INDICATION?
YES
REFER TO MFD FAULT CODES
NO
PERFORM DRY MOTORING RUN. IS MOTORING SPEED 11% N2 MINIMUM?
NO
CHECK A/C STARTER VOLTAGE / CURRENT AND CIRCUITS REF. AMM
REPEAT START PROCEDURE
YES
INSPECT EXTERNAL P3 SUPPLY TUBES TO EEC OR P3 TRANSDUCER AND BLEED PORTS.
DISCONNECT P3 LINE TO BOV SOLENOID AND REPEAT START. IS IT SATISFACTORY?
NO
PUSH BOVS OPEN AND REPEAT START. IS IT SATISFACTORY?
NO
YES
REMOVE BOVS INSPECT, CLEAN OR REPLACE AS NECESSARY (REF. 75-30-01). RECONNECT P3, REPEAT START PROCEDURE.
YES
REPLACE SOLENOID. RECONNECT P3 TO SOLENOID
REPEAT START PROCEDURE
CHECK FOR PROPER FUEL FLOW FROM HMU METERED FLOW AND PILOT FLOW PORTS MIN.110 PPH - MAX.200 PPH IS IT SATISFACTORY?
NO
REPLACE HMU ASS'Y
REPEAT START PROCEDURE
YES
CHECK OPERATION OF DUMP VALVE. IS IT SATISFACTORY?
NO
REPLACE DUMP VALVE
YES
CHECK ENGINE EMERGENCY FUEL SHUT-OFF VALVE. IS IT SATISFACTORY?
NO
REPAIR / REPLACE EMERGENCY SHUT-OFF VALVE
YES
INSPECT / REPLACE MAIN FUEL NOZZLE ASS'YS / FILTERS
REPEAT START PROCEDURE

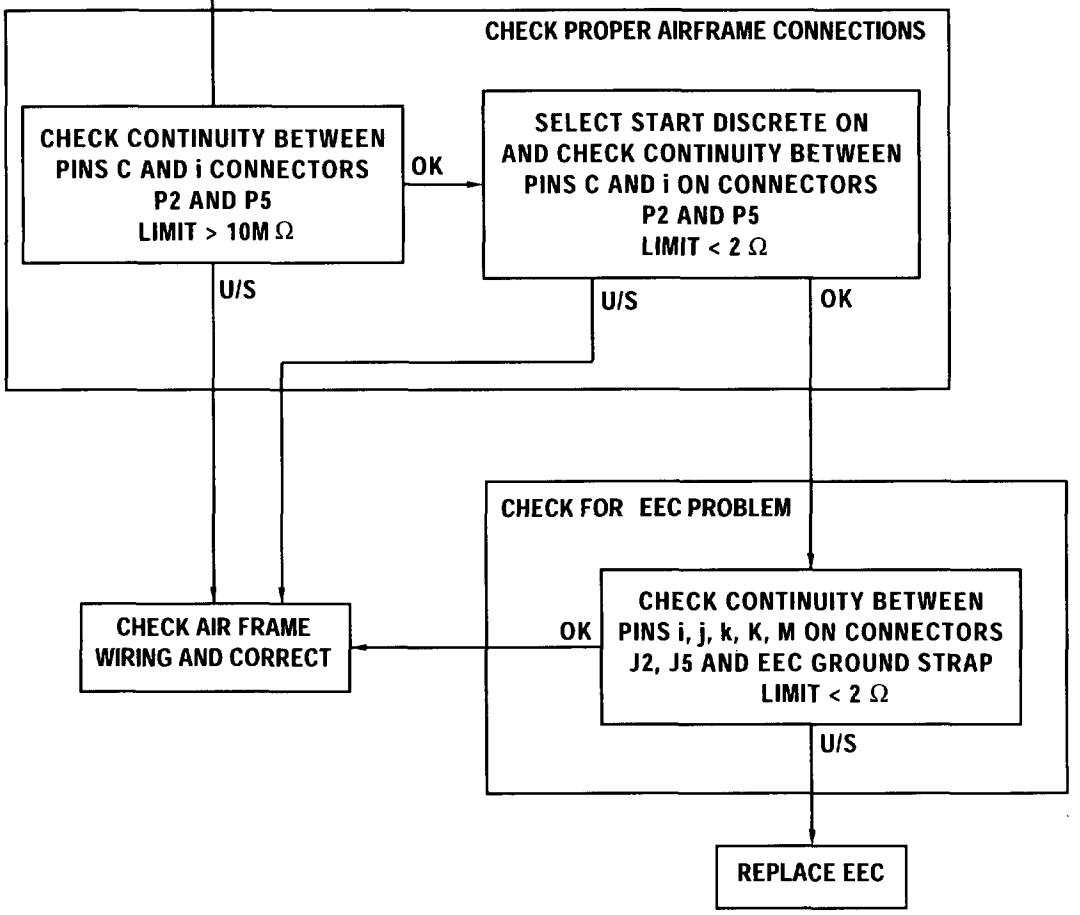
C32166D

Starting Problems - Hung Start
Figure 107


NO N1 SPEED DURING START
NOTE: REFER TO CHAPTER 71-00-00, ADJUSTMENT/TEST, ENGINE START FOR STARTING PROCEDURE.
CHECK THE N1 SPOOL BY TURNING THE FAN IN THE CORRECT DIRECTION TO MAKE SURE IT IS NOT MECHANICALLY SEIZED. DOES THE N1 SPOOL TURN FREELY?
NO
YES
ALLOW THE ENGINE TO COOL FOR ONE HOUR. CHECK THE N1 SPOOL BY TURNING THE FAN IN THE CORRECT DIRECTION TO MAKE SURE IT IS NOT MECHANICALLY SEIZED. DOES THE N1 SPOOL TURN FREELY?
YES
NO
USE THE FAULT ISOLATION CHART FOR FAULT CODE DB
RETURN THE ENGINE TO AN APPROVED OVERHAUL FACILITY.
C93283

No N1 Speed During Start
Figure 108

START DISCRETE FUNCTIONAL CHECK - (START DISCRETE OPERATION REQUIRES CORRECT CONNECTIONS ON THE AIRFRAME AND THE EEC)

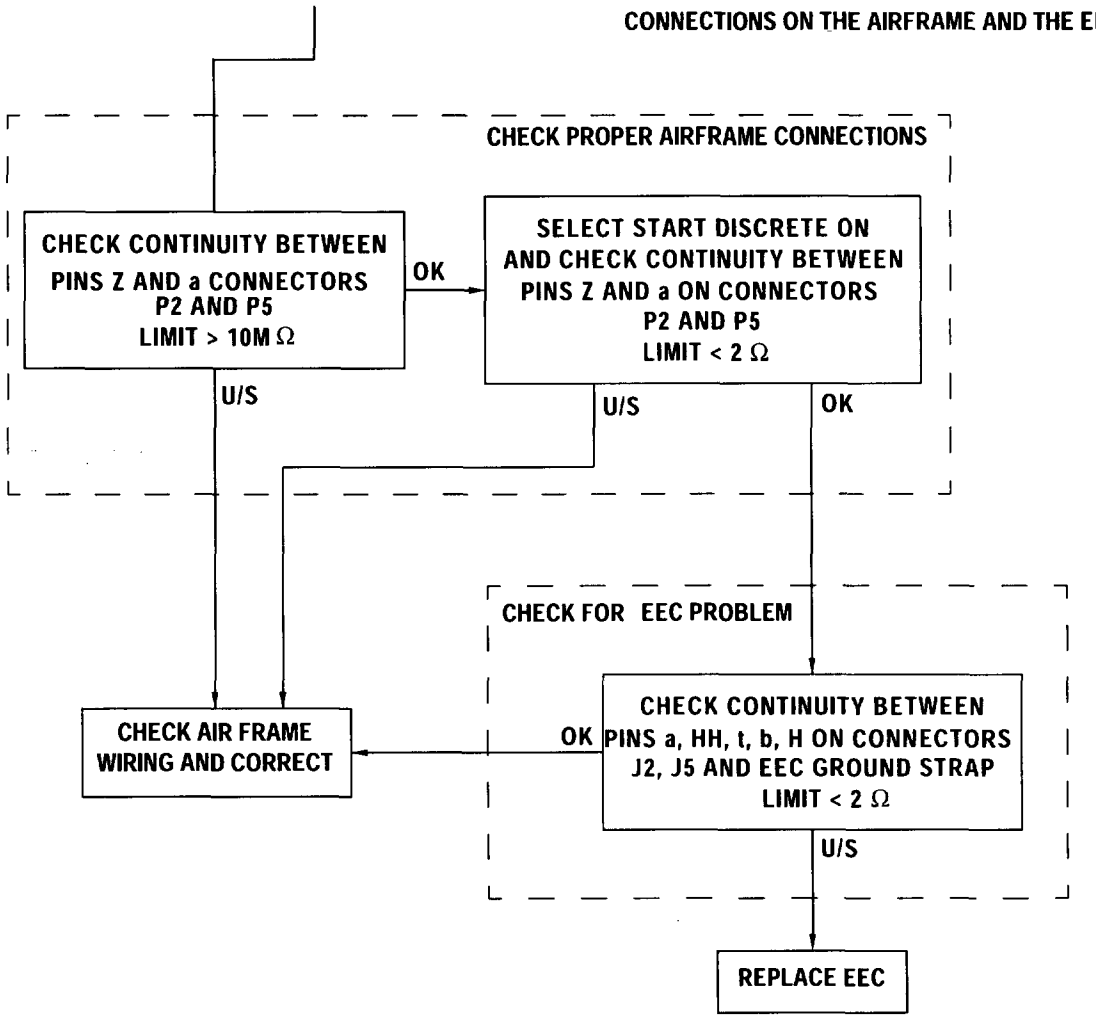

CHECK PROPER AIRFRAME CONNECTIONS
CHECK CONTINUITY BETWEEN PINS C AND i CONNECTORS P2 AND P5 LIMIT > 10M Ω
OK
SELECT START DISCRETE ON AND CHECK CONTINUITY BETWEEN PINS C AND i ON CONNECTORS P2 AND P5 LIMIT < 2 Ω
U/S
U/S
OK
CHECK FOR EEC PROBLEM
CHECK AIR FRAME WIRING AND CORRECT
OK
CHECK CONTINUITY BETWEEN PINS i, j, k, K, M ON CONNECTORS J2, J5 AND EEC GROUND STRAP LIMIT < 2 Ω
U/S
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2, J2
B	P5, J5

Pre-SB24434/Post-SB24514 C33378A

Starting Problems - Start Discrete Functional Check
Figure 109 (Sheet 1 of 2)

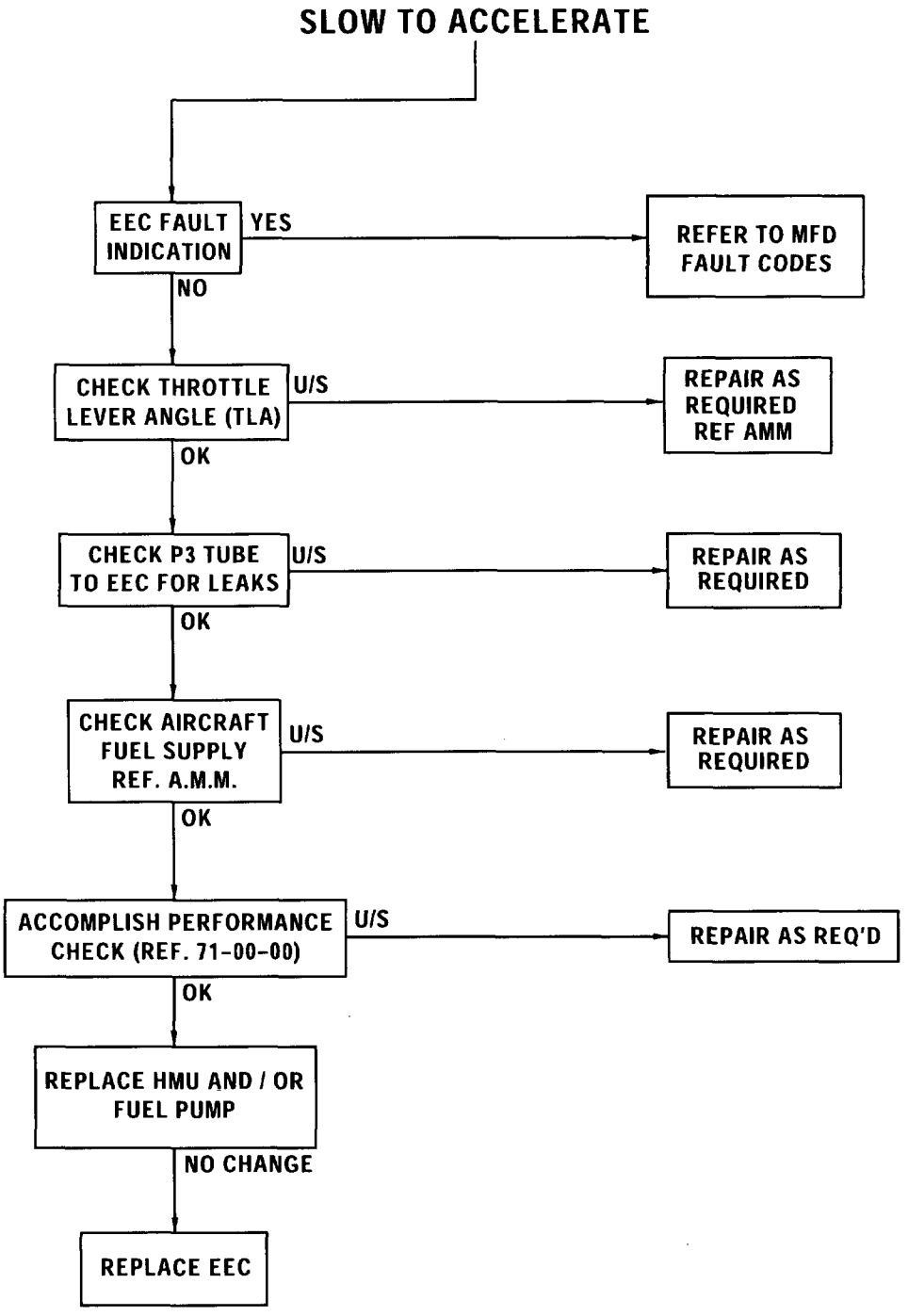
START DISCRETE FUNCTIONAL CHECK - (START DISCRETE OPERATION REQUIRES CORRECT CONNECTIONS ON THE AIRFRAME AND THE EEC)


CHECK PROPER AIRFRAME CONNECTIONS
CHECK CONTINUITY BETWEEN PINS Z AND a CONNECTORS P2 AND P5 LIMIT > 10M Ω
OK
SELECT START DISCRETE ON AND CHECK CONTINUITY BETWEEN PINS Z AND a ON CONNECTORS P2 AND P5 LIMIT < 2 Ω
U/S
U/S
OK
CHECK FOR EEC PROBLEM
CHECK AIR FRAME WIRING AND CORRECT
OK
CHECK CONTINUITY BETWEEN PINS a, HH, t, b, H ON CONNECTORS J2, J5 AND EEC GROUND STRAP LIMIT < 2 Ω
U/S
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2, J2
B	P5, J5

Post-SB24434/Pre-SB24514 C64062

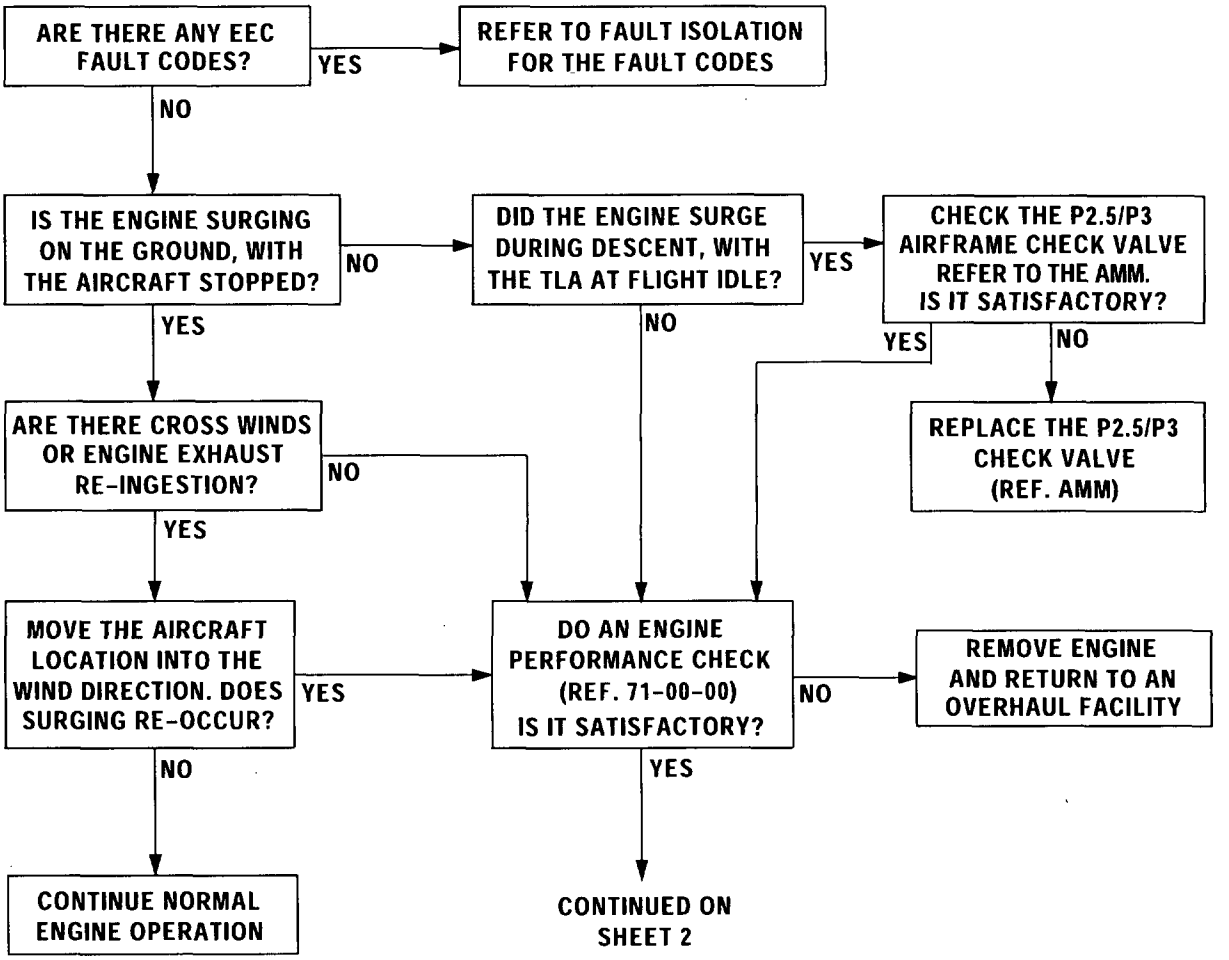
Starting Problems - Start Discrete Functional Check
Figure 109 (Sheet 2)



C32219B

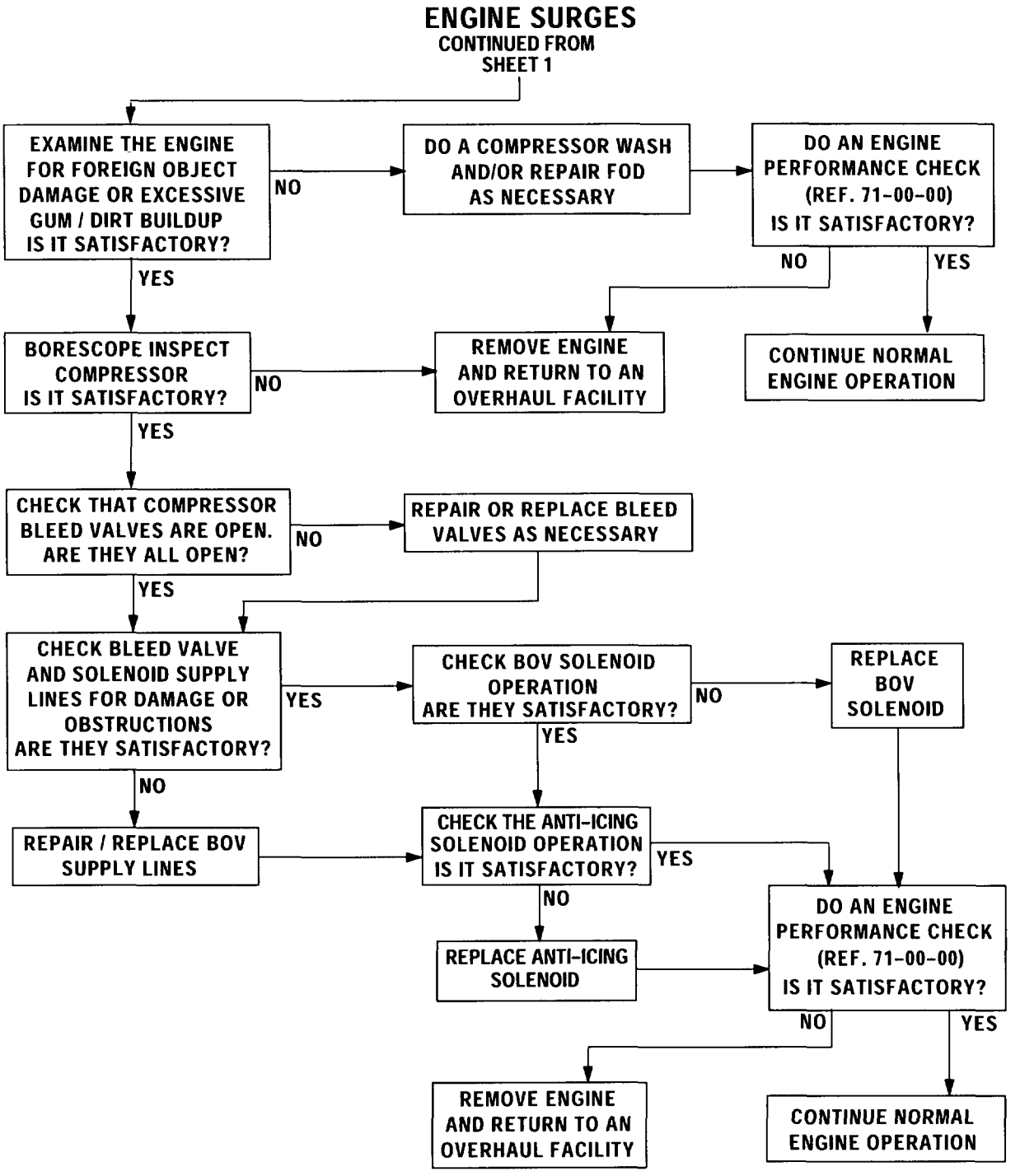
Operating Problems - Slow to Accelerate
Figure 110

ENGINE SURGES

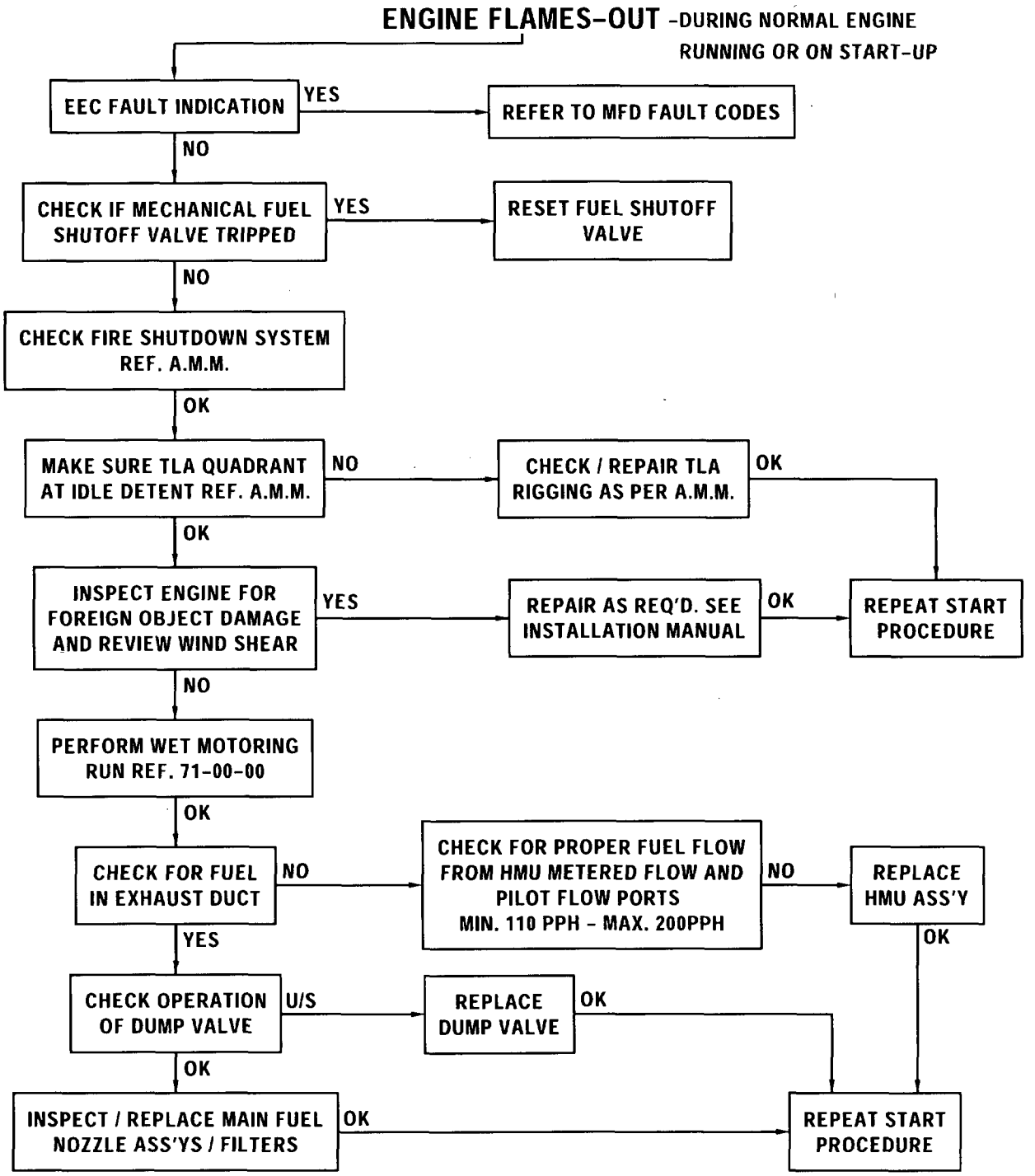

ARE THERE ANY EEC FAULT CODES?
YES
REFER TO FAULT ISOLATION FOR THE FAULT CODES
NO
IS THE ENGINE SURGING ON THE GROUND, WITH THE AIRCRAFT STOPPED?
NO
DID THE ENGINE SURGE DURING DESCENT, WITH THE TLA AT FLIGHT IDLE?
YES
CHECK THE P2.5/P3 AIRFRAME CHECK VALVE REFER TO THE AMM. IS IT SATISFACTORY?
YES
NO
REPLACE THE P2.5/P3 CHECK VALVE (REF. AMM)
YES
NO
ARE THERE CROSS WINDS OR ENGINE EXHAUST RE-INGESTION?
YES
NO
MOVE THE AIRCRAFT LOCATION INTO THE WIND DIRECTION. DOES SURGING RE-OCCUR?
YES
NO
DO AN ENGINE PERFORMANCE CHECK (REF. 71-00-00) IS IT SATISFACTORY?
NO
REMOVE ENGINE AND RETURN TO AN OVERHAUL FACILITY
YES
CONTINUE NORMAL ENGINE OPERATION
CONTINUED ON SHEET 2

C96585

Operating Problems - Engine Surges
Figure 111 (Sheet 1 of 2)

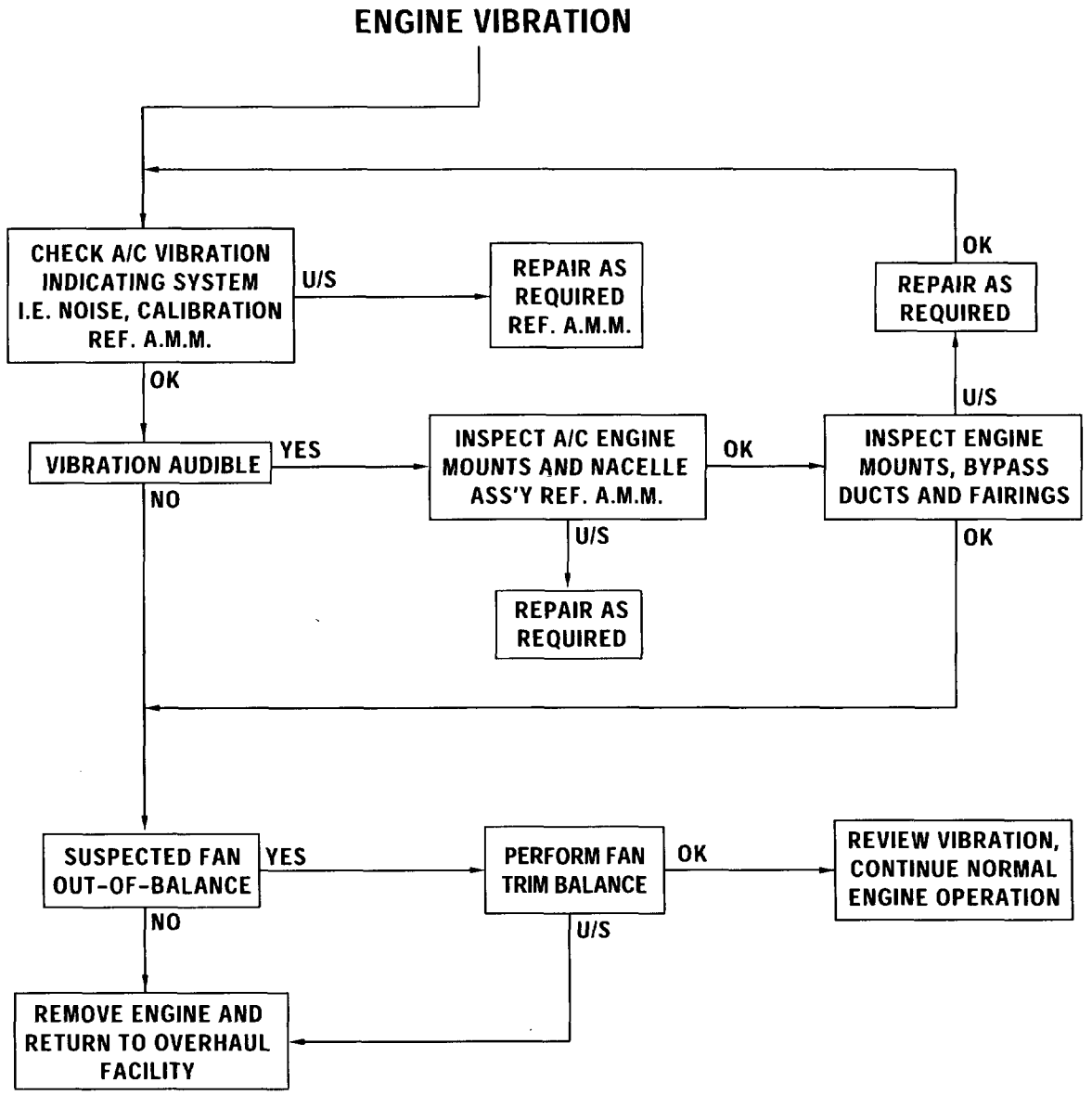

ENGINE SURGES
CONTINUED FROM SHEET 1
EXAMINE THE ENGINE FOR FOREIGN OBJECT DAMAGE OR EXCESSIVE GUM / DIRT BUILDUP IS IT SATISFACTORY?
NO
DO A COMPRESSOR WASH AND/OR REPAIR FOD AS NECESSARY
DO AN ENGINE PERFORMANCE CHECK (REF. 71-00-00) IS IT SATISFACTORY?
NO
YES
YES
BORESCOPE INSPECT COMPRESSOR IS IT SATISFACTORY?
NO
REMOVE ENGINE AND RETURN TO AN OVERHAUL FACILITY
CONTINUE NORMAL ENGINE OPERATION
YES
CHECK THAT COMPRESSOR BLEED VALVES ARE OPEN. ARE THEY ALL OPEN?
NO
REPAIR OR REPLACE BLEED VALVES AS NECESSARY
YES
CHECK BLEED VALVE AND SOLENOID SUPPLY LINES FOR DAMAGE OR OBSTRUCTIONS ARE THEY SATISFACTORY?
YES
CHECK BOV SOLENOID OPERATION ARE THEY SATISFACTORY?
NO
REPLACE BOV SOLENOID
YES
NO
REPAIR / REPLACE BOV SUPPLY LINES
CHECK THE ANTI-ICING SOLENOID OPERATION IS IT SATISFACTORY?
YES
NO
REPLACE ANTI-ICING SOLENOID
DO AN ENGINE PERFORMANCE CHECK (REF. 71-00-00) IS IT SATISFACTORY?
NO
YES
REMOVE ENGINE AND RETURN TO AN OVERHAUL FACILITY
CONTINUE NORMAL ENGINE OPERATION
C96586

Operating Problems - Engine Surges
Figure 111 (Sheet 2)



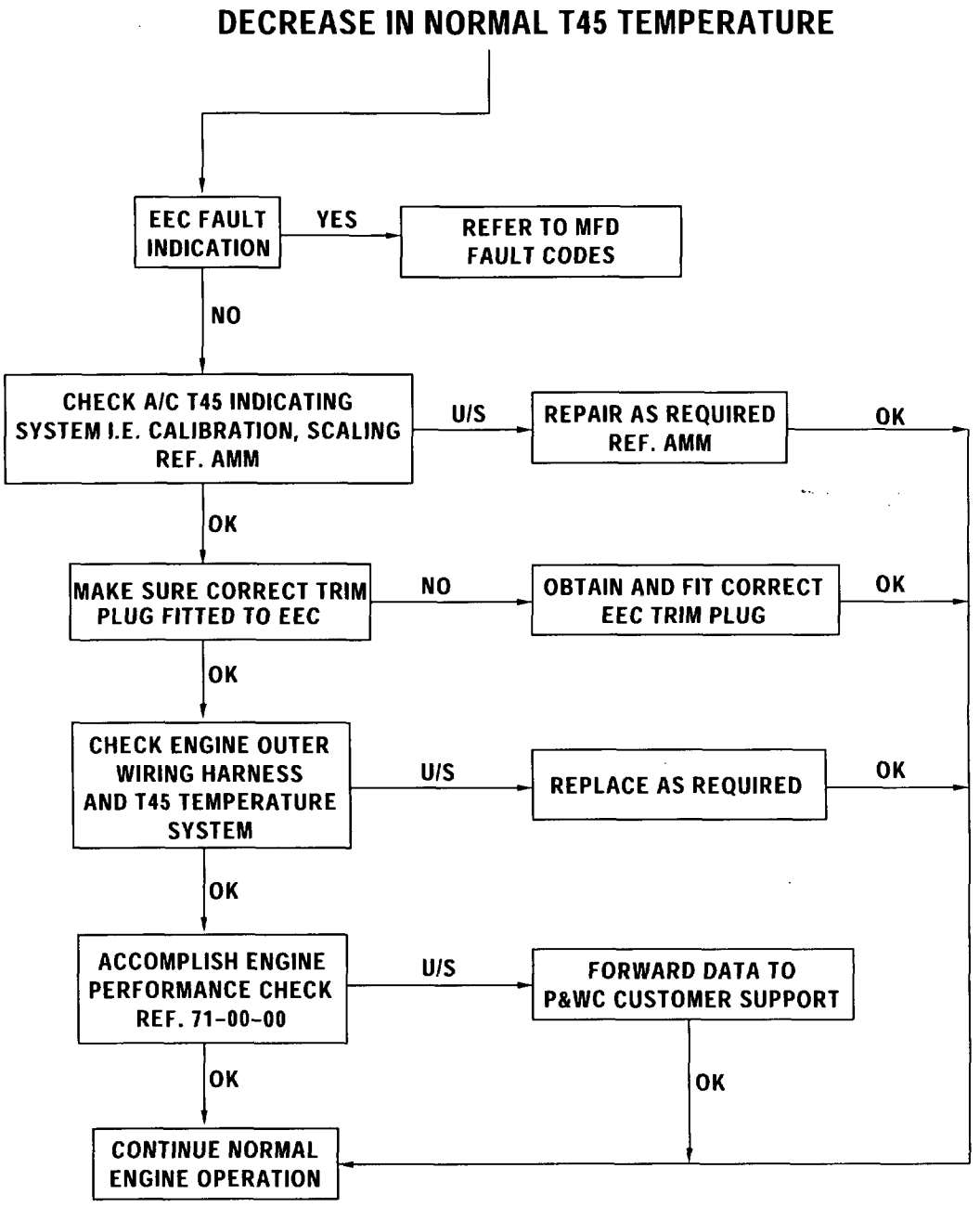
C32163C

Operating Problems - Engine Flame-out
Figure 112



C32176B

Operating Problems - Engine Vibration
Figure 113

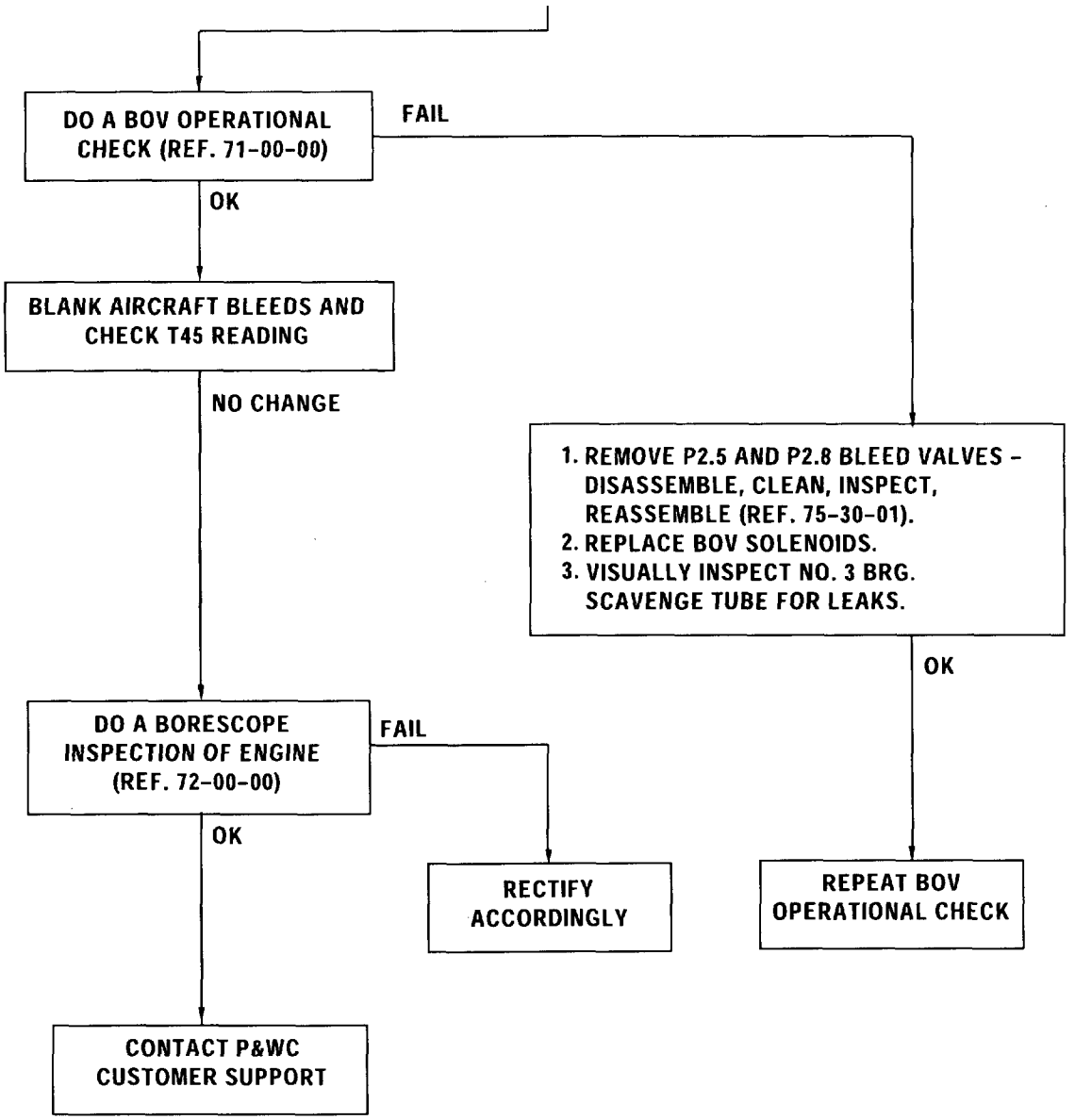


C32175A

Operating Problems - Decrease in Normal T45 Temperature
Figure 114

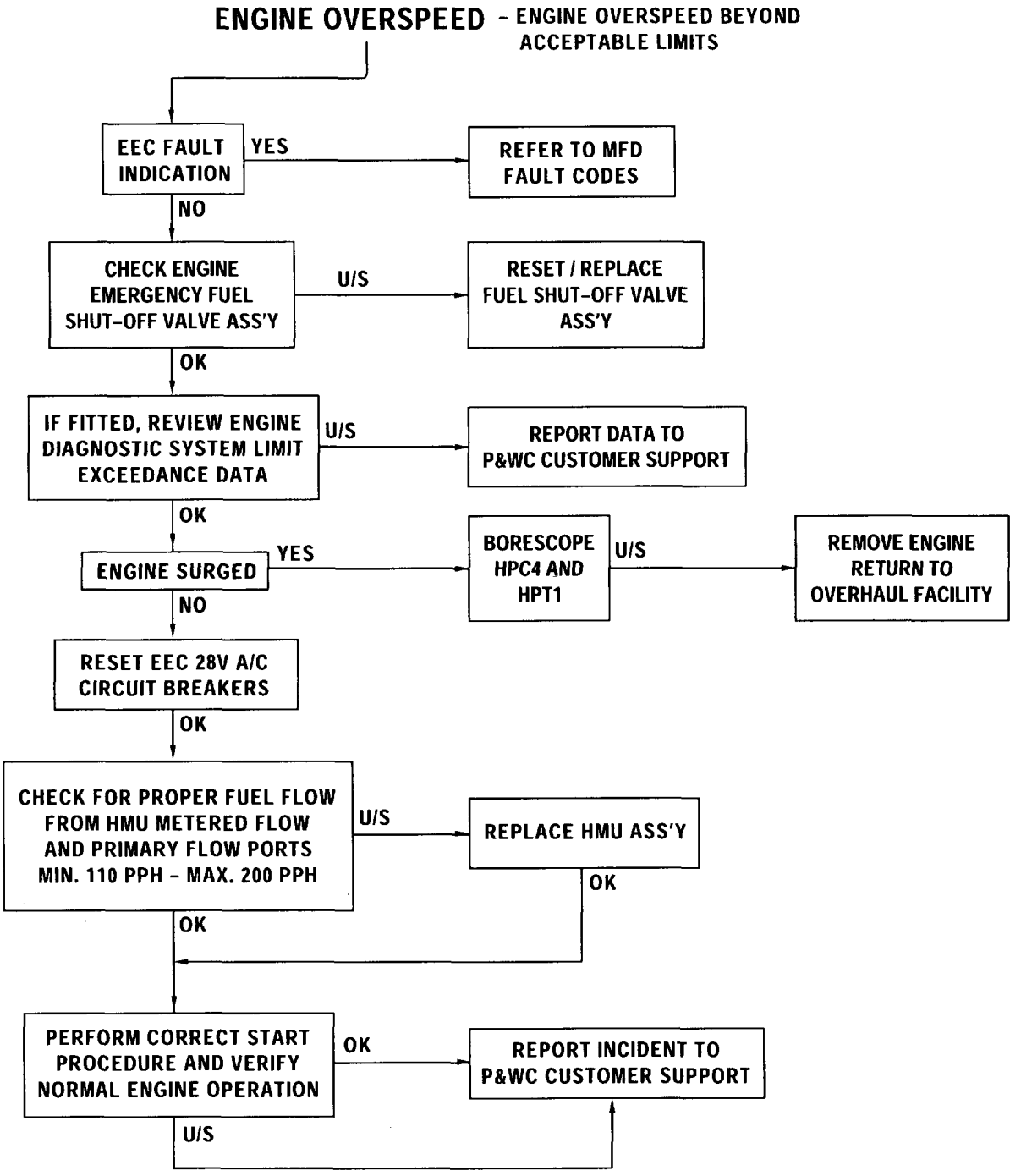
T45 INCREASE BETWEEN SUBSEQUENT FLIGHTS OF 20°C OR MORE

- IN CRUISE, ON ONE ENGINE WHEN COMPARED TO OTHER ENGINE


DO A BOV OPERATIONAL CHECK (REF. 71-00-00)
FAIL
OK
BLANK AIRCRAFT BLEEDS AND CHECK T45 READING
NO CHANGE
1. REMOVE P2.5 AND P2.8 BLEED VALVES - DISASSEMBLE, CLEAN, INSPECT, REASSEMBLE (REF. 75-30-01).
2. REPLACE BOV SOLENOIDS.
3. VISUALLY INSPECT NO. 3 BRG. SCAVENGE TUBE FOR LEAKS.
OK
DO A BORESCOPE INSPECTION OF ENGINE (REF. 72-00-00)
FAIL
OK
RECTIFY ACCORDINGLY
REPEAT BOV OPERATIONAL CHECK
CONTACT P&WC CUSTOMER SUPPORT

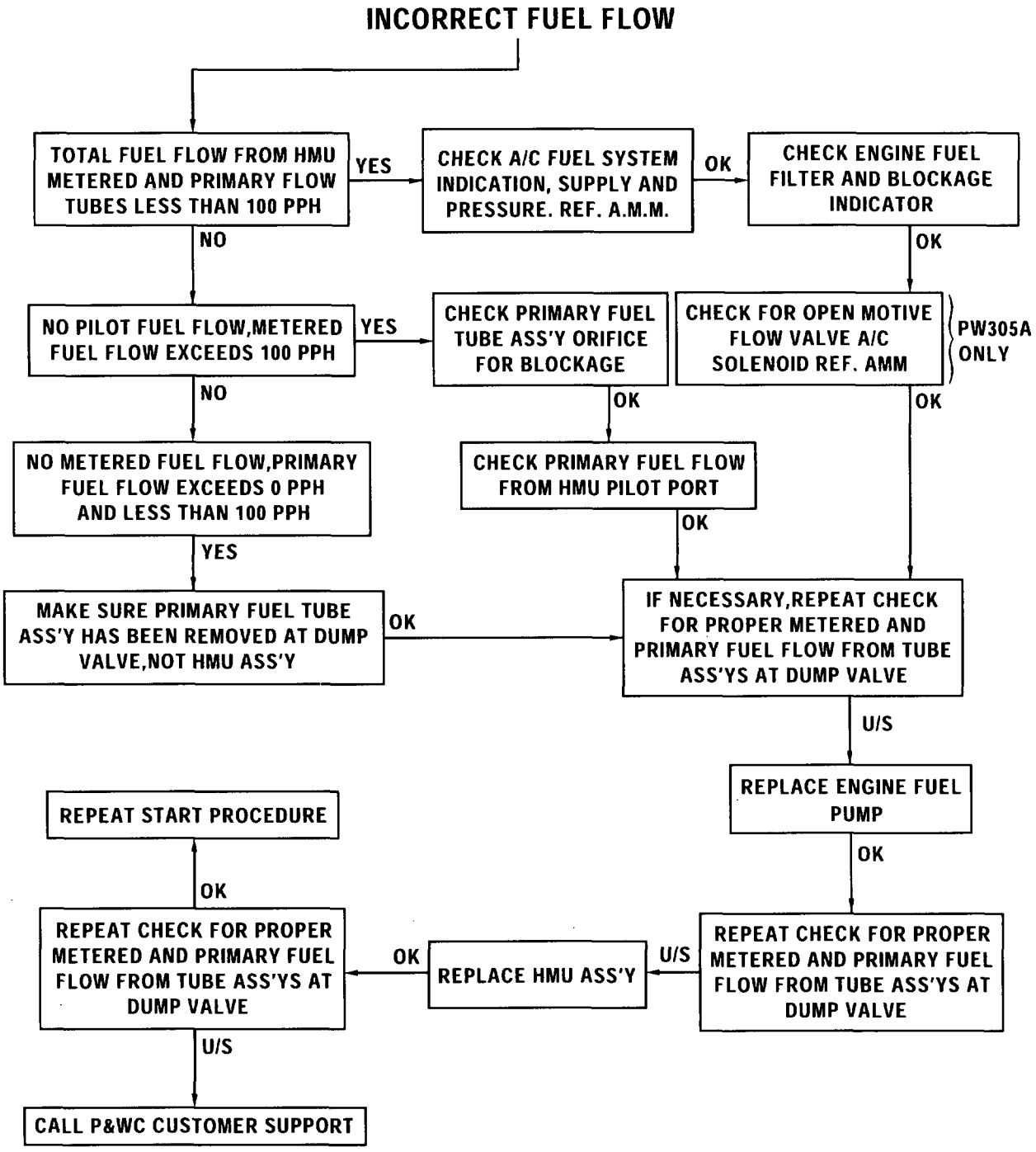
C65323A

Operating Problems - Increase in Normal T45 Temperature
Figure 115



C32174B

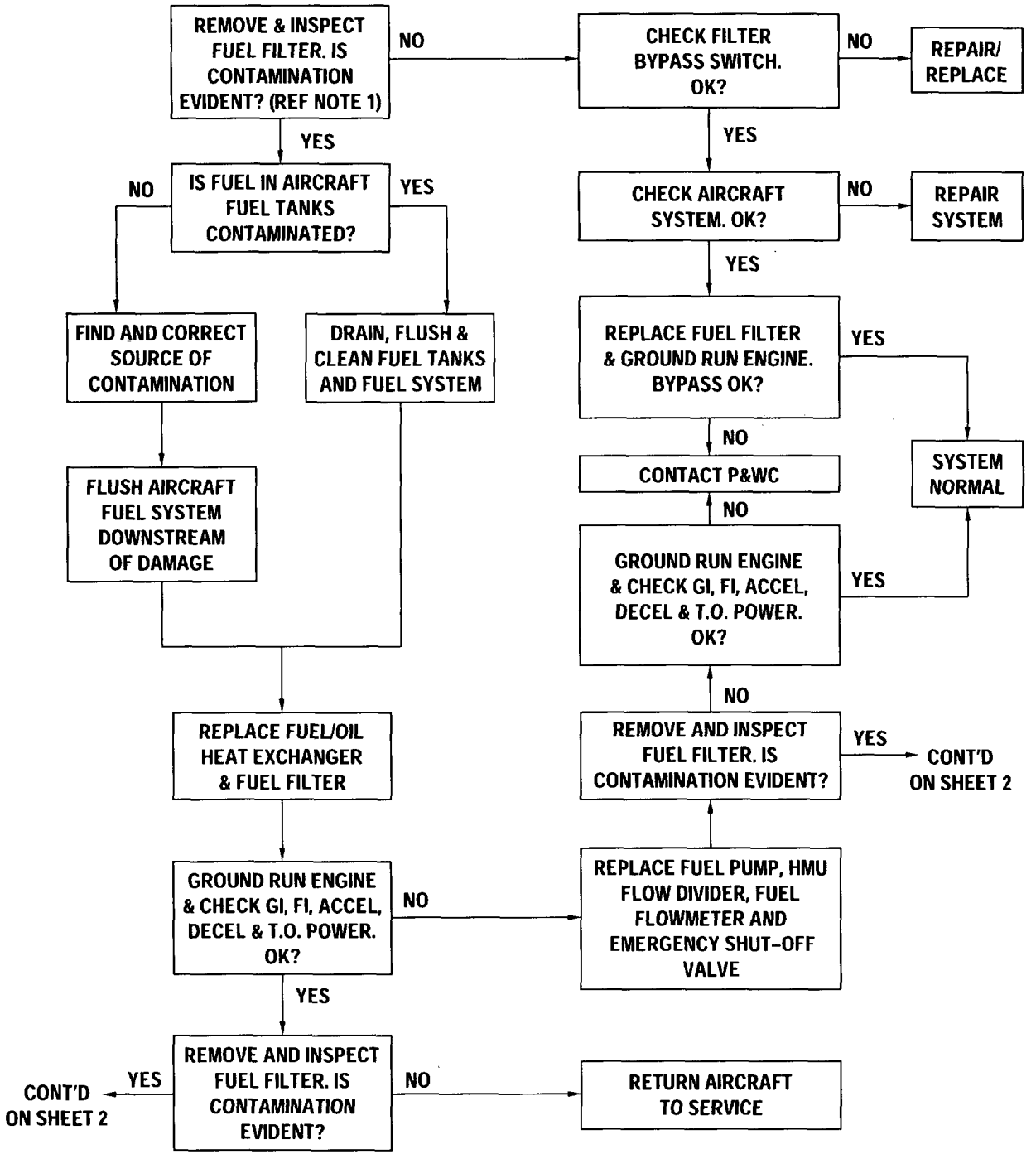
Operating Problems - Engine Overspeed
Figure 116


INCORRECT FUEL FLOW
TOTAL FUEL FLOW FROM HMU METERED AND PRIMARY FLOW TUBES LESS THAN 100 PPH
YES
CHECK A/C FUEL SYSTEM INDICATION, SUPPLY AND PRESSURE. REF. A.M.M.
OK
CHECK ENGINE FUEL FILTER AND BLOCKAGE INDICATOR
NO
OK
NO PILOT FUEL FLOW,METERED FUEL FLOW EXCEEDS 100 PPH
YES
CHECK PRIMARY FUEL TUBE ASS'Y ORIFICE FOR BLOCKAGE
CHECK FOR OPEN MOTIVE FLOW VALVE A/C SOLENOID REF. AMM
PW305A ONLY
NO
OK
OK
NO METERED FUEL FLOW,PRIMARY FUEL FLOW EXCEEDS 0 PPH AND LESS THAN 100 PPH
CHECK PRIMARY FUEL FLOW FROM HMU PILOT PORT
OK
YES
MAKE SURE PRIMARY FUEL TUBE ASS'Y HAS BEEN REMOVED AT DUMP VALVE,NOT HMU ASS'Y
OK
IF NECESSARY,REPEAT CHECK FOR PROPER METERED AND PRIMARY FUEL FLOW FROM TUBE ASS'YS AT DUMP VALVE
U/S
REPLACE ENGINE FUEL PUMP
OK
REPEAT START PROCEDURE
OK
REPEAT CHECK FOR PROPER METERED AND PRIMARY FUEL FLOW FROM TUBE ASS'YS AT DUMP VALVE
OK
REPLACE HMU ASS'Y
U/S
REPEAT CHECK FOR PROPER METERED AND PRIMARY FUEL FLOW FROM TUBE ASS'YS AT DUMP VALVE
U/S
CALL P&WC CUSTOMER SUPPORT

C32165B

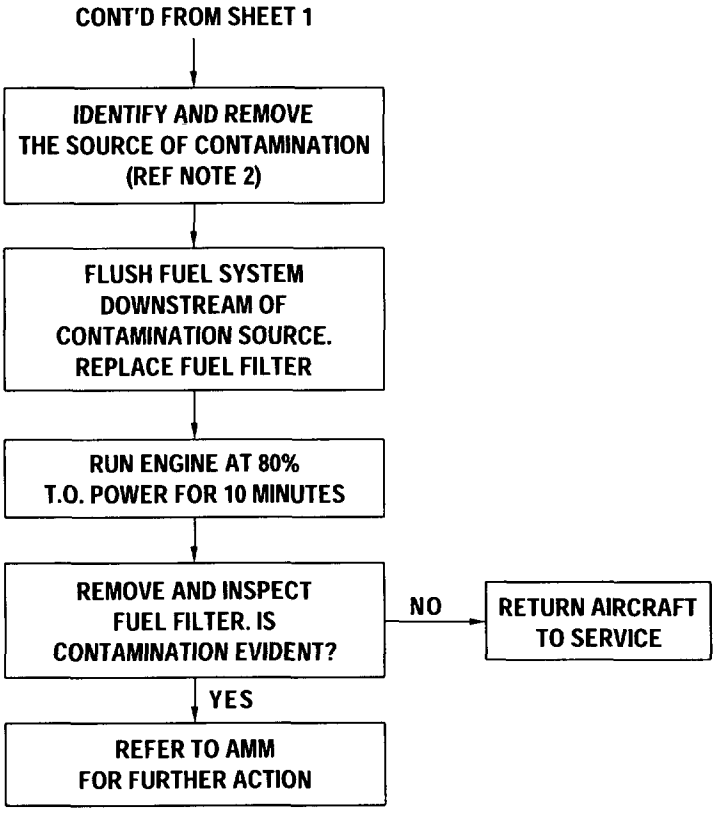
Operating Problems - Incorrect Fuel Flow
Figure 117

FUEL FILTER BYPASS INDICATION


REMOVE & INSPECT FUEL FILTER. IS CONTAMINATION EVIDENT? (REF NOTE 1)
NO
CHECK FILTER BYPASS SWITCH. OK?
NO
REPAIR/ REPLACE
YES
YES
IS FUEL IN AIRCRAFT FUEL TANKS CONTAMINATED?
NO
YES
CHECK AIRCRAFT SYSTEM. OK?
NO
REPAIR SYSTEM
YES
FIND AND CORRECT SOURCE OF CONTAMINATION
DRAIN, FLUSH & CLEAN FUEL TANKS AND FUEL SYSTEM
REPLACE FUEL FILTER & GROUND RUN ENGINE. BYPASS OK?
YES
NO
SYSTEM NORMAL
CONTACT P&WC
NO
FLUSH AIRCRAFT FUEL SYSTEM DOWNSTREAM OF DAMAGE
GROUND RUN ENGINE & CHECK GI, FI, ACCEL, DECEL & T.O. POWER. OK?
YES
NO
REPLACE FUEL/OIL HEAT EXCHANGER & FUEL FILTER
REMOVE AND INSPECT FUEL FILTER. IS CONTAMINATION EVIDENT?
YES
CONT'D ON SHEET 2
GROUND RUN ENGINE & CHECK GI, FI, ACCEL, DECEL & T.O. POWER. OK?
NO
REPLACE FUEL PUMP, HMU FLOW DIVIDER, FUEL FLOWMETER AND EMERGENCY SHUT-OFF VALVE
YES
CONT'D ON SHEET 2
YES
REMOVE AND INSPECT FUEL FILTER. IS CONTAMINATION EVIDENT?
NO
RETURN AIRCRAFT TO SERVICE
C128142

Operating Problems - Fuel Filter Bypass Indication
Figure 118 (Sheet 1 of 2)

FUEL FILTER BYPASS INDICATION

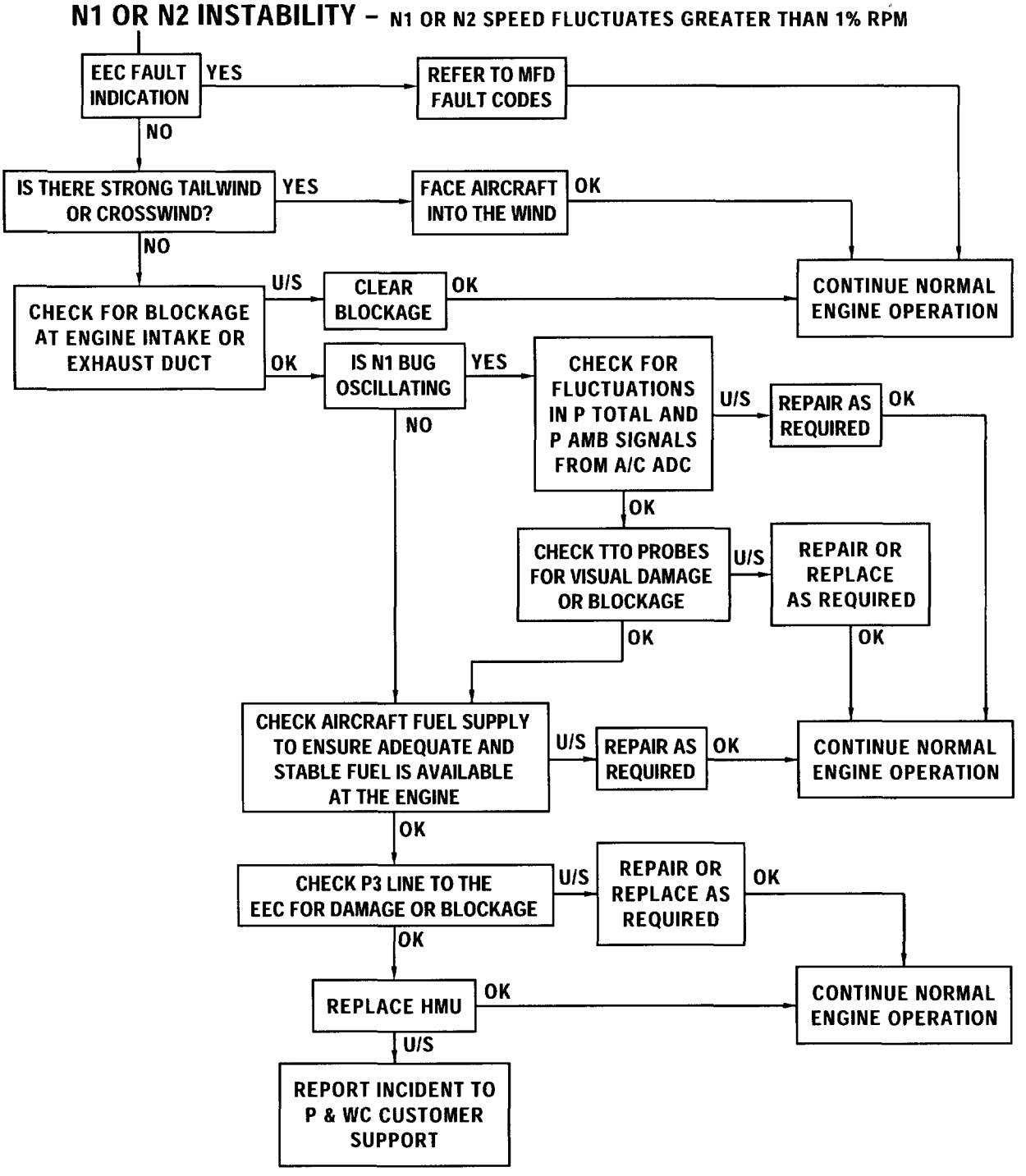

CONT'D FROM SHEET 1
IDENTIFY AND REMOVE THE SOURCE OF CONTAMINATION (REF NOTE 2)
FLUSH FUEL SYSTEM DOWNSTREAM OF CONTAMINATION SOURCE. REPLACE FUEL FILTER
RUN ENGINE AT 80% T.O. POWER FOR 10 MINUTES
REMOVE AND INSPECT FUEL FILTER. IS CONTAMINATION EVIDENT?
NO
RETURN AIRCRAFT TO SERVICE
YES
REFER TO AMM FOR FURTHER ACTION

NOTE 1: A BYPASS INDICATION DOES NOT NECESSARILY MEAN THAT THE FUEL FILTER WAS BYPASSED. A VISUAL INSPECTION TO CHECK THE AMOUNT OF CONTAMINATION COLLECTED BY THE FILTER COULD INDICATE IF EXCESS CONTAMINATION WAS RELEASED INTO THE FUEL SYSTEM IN A SHORT TIME (EX. MICROBIOLOGICAL CONTAMINATION, MAINTENANCE INDUCED CONTAMINATION, ETC.). IF DEBRIS IS DEPOSITED ON MOST OF FILTER ELEMENT SURFACE, THEN CONTAMINATION IS EVIDENT.

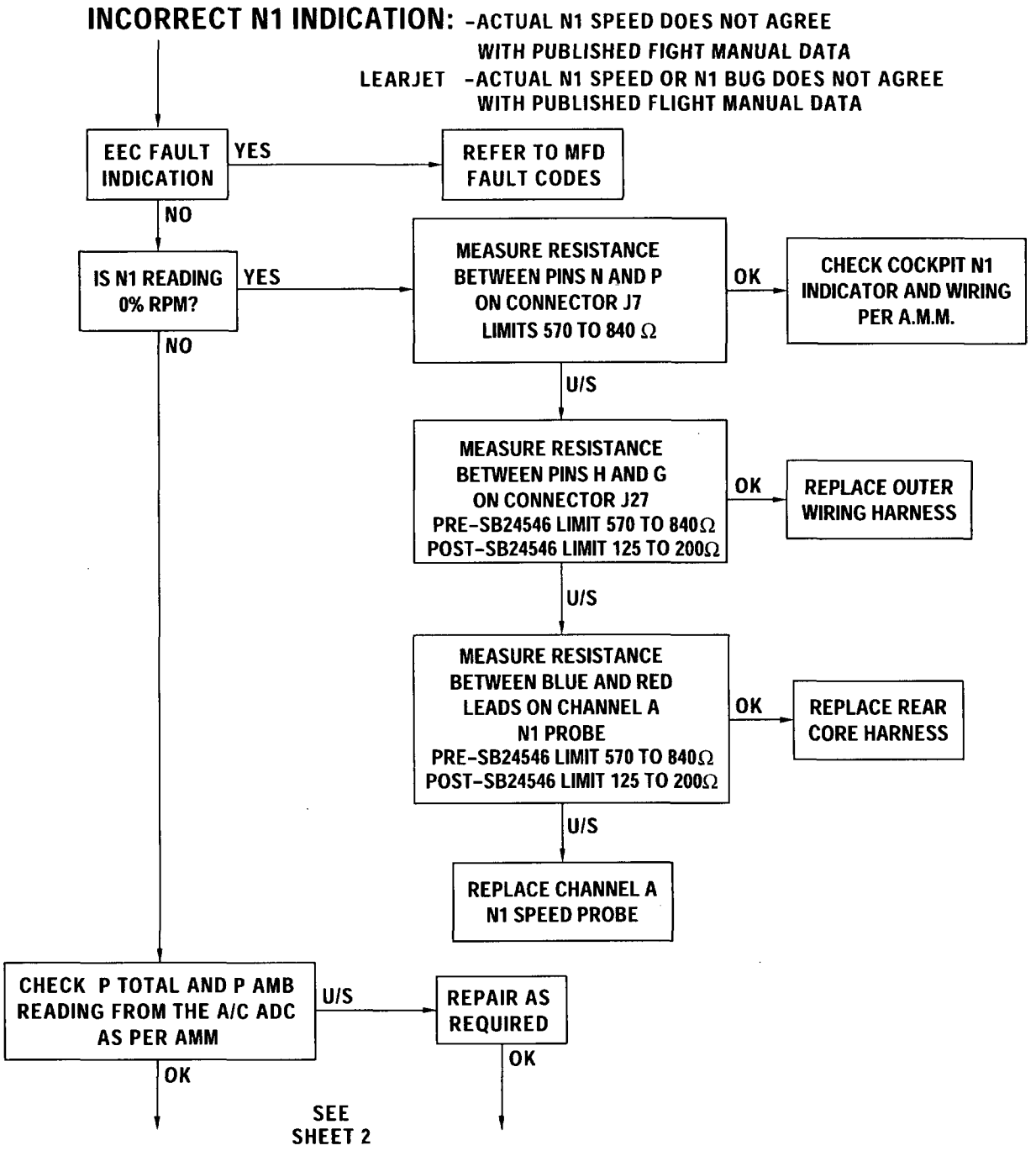
NOTE 2: CONTAMINATION MAY BE TRAPPED IN THE FUEL PUMP. IN THIS CASE IT IS RECOMMENDED THAT THE FUEL PUMP BE CHANGED.

C74718

Operating Problems - Fuel Filter Bypass Indication
Figure 118 (Sheet 2)

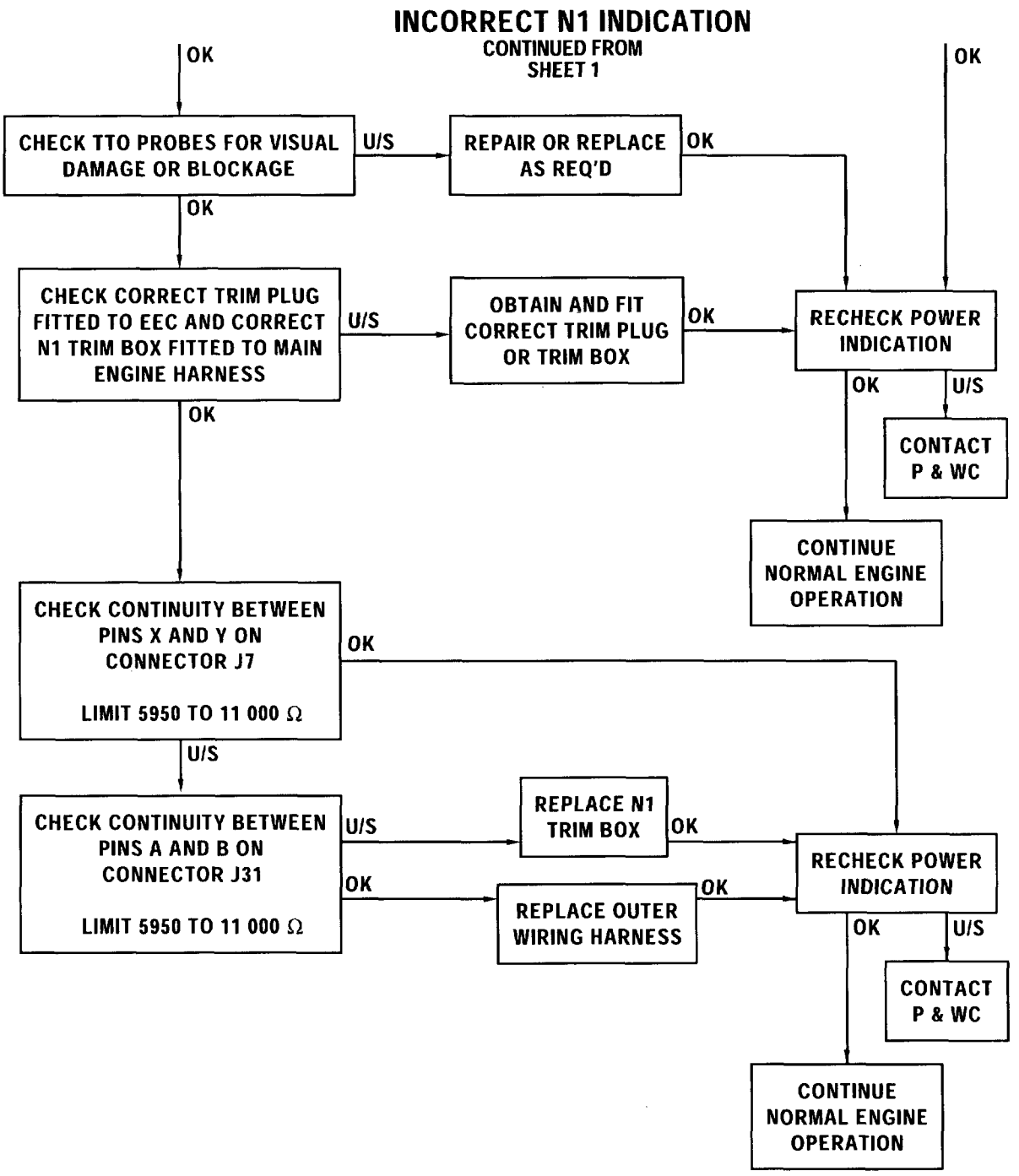


Operating Problems - N1 or N2 Instability
Figure 119


INCORRECT N1 INDICATION: -ACTUAL N1 SPEED DOES NOT AGREE WITH PUBLISHED FIGHT MANUAL DATA
LEARJET -ACTUAL N1 SPEED OR N1 BUG DOES NOT AGREE WITH PUBLISHED FLIGHT MANUAL DATA
EEC FAULT INDICATION
YES
REFER TO MFD FAULT CODES
NO
IS N1 READING 0% RPM?
YES
MEASURE RESISTANCE BETWEEN PINS N AND P ON CONNECTOR J7 LIMITS 570 TO 840 Ω
OK
CHECK COCKPIT N1 INDICATOR AND WIRING PER A.M.M.
NO
U/S
MEASURE RESISTANCE BETWEEN PINS H AND G ON CONNECTOR J27 PRE-SB24546 LIMIT 570 TO 840Ω POST-SB24546 LIMIT 125 TO 200Ω
OK
REPLACE OUTER WIRING HARNESS
U/S
MEASURE RESISTANCE BETWEEN BLUE AND RED LEADS ON CHANNEL A N1 PROBE PRE-SB24546 LIMIT 570 TO 840Ω POST-SB24546 LIMIT 125 TO 200Ω
OK
REPLACE REAR CORE HARNESS
U/S
REPLACE CHANNEL A N1 SPEED PROBE
CHECK P TOTAL AND P AMB READING FROM THE A/C ADC AS PER AMM
U/S
REPAIR AS REQUIRED
OK
OK
SEE SHEET 2

C33381B

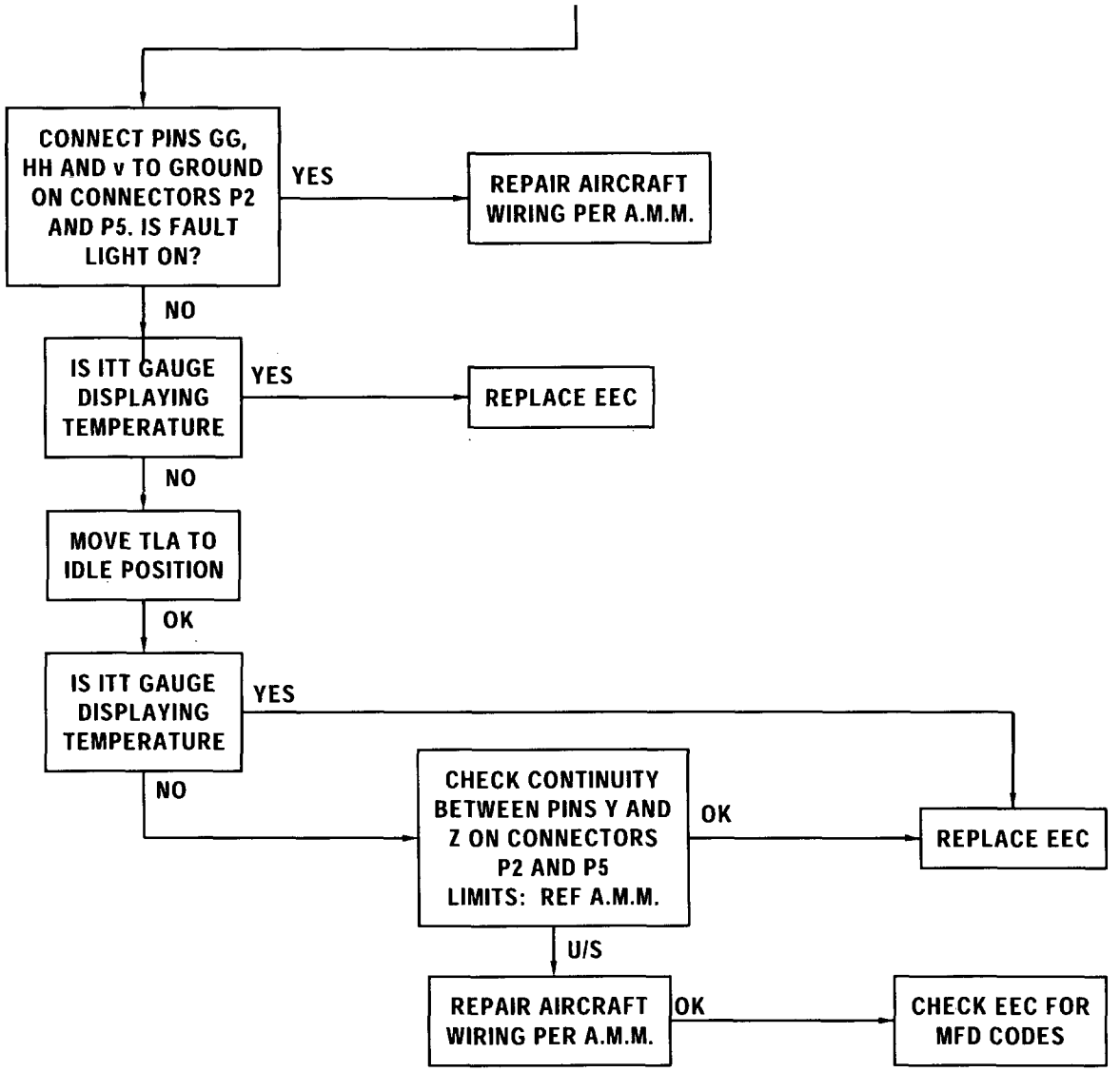
Operating Problems - Incorrect N1 Indication
Figure 120 (Sheet 1 of 2)



C32224

Operating Problems - Incorrect N1 Indication
Figure 120 (Sheet 2)

FADEC FAULT LIGHT WITH NO APPLICABLE MFD CODE

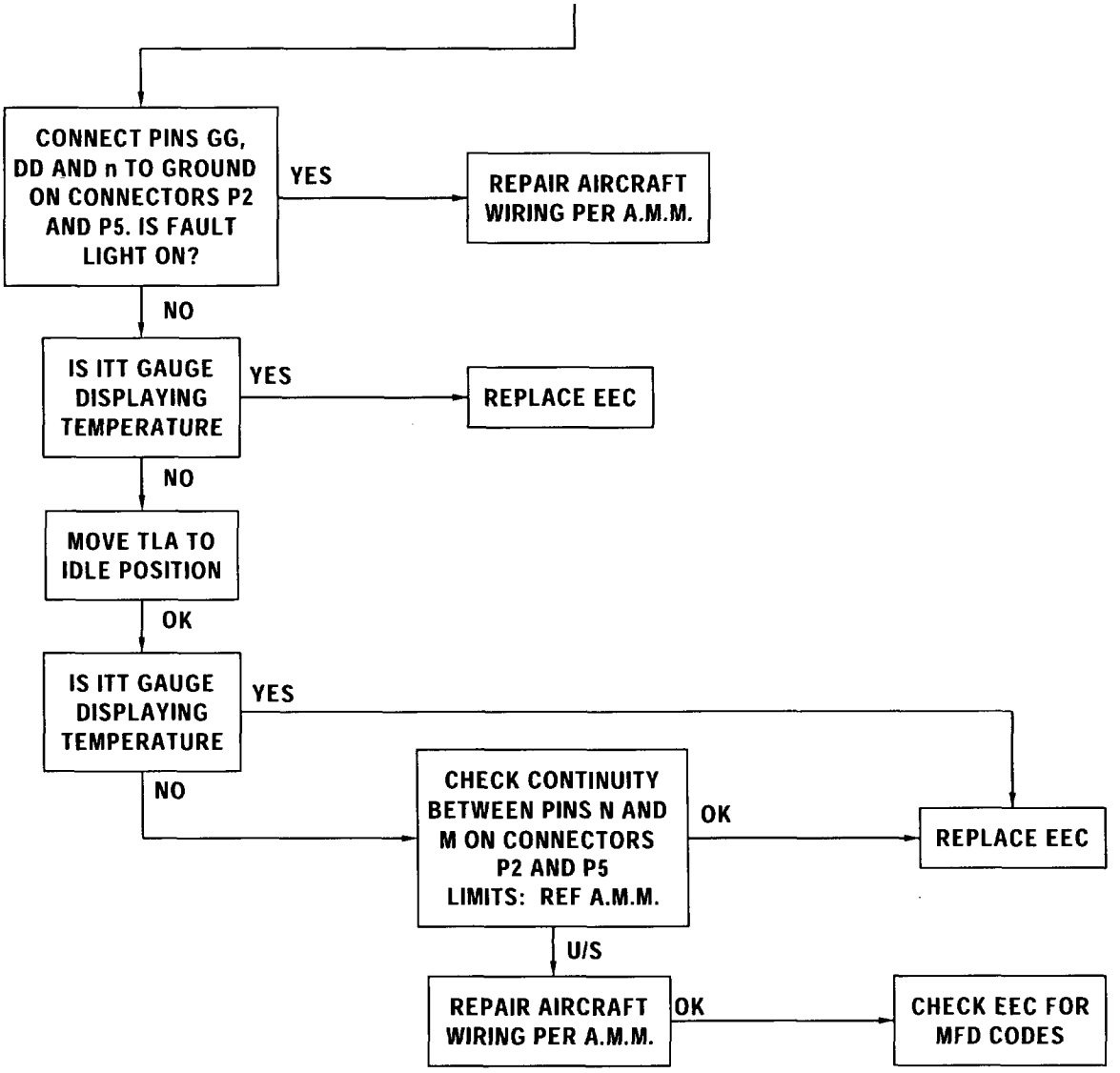


FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

Pre-SB24434/Post-SB24514 C33829

Operating Problems - FADEC Fault Light with no Applicable MFD Code
Figure 121 (Sheet 1 of 2)

FADEC FAULT LIGHT WITH NO APPLICABLE MFD CODE

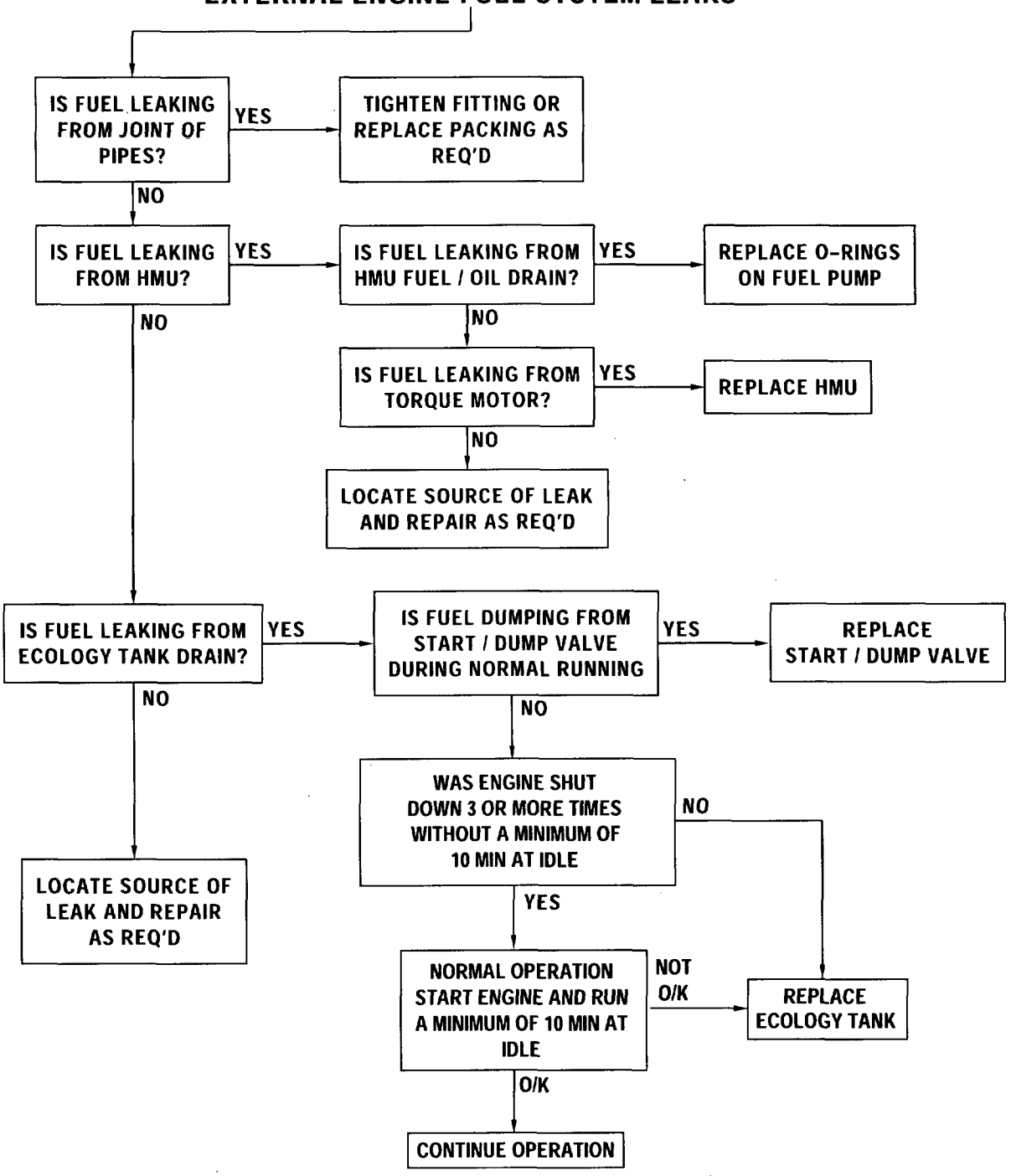


FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

Post-SB24434/Pre-SB24514 C64064

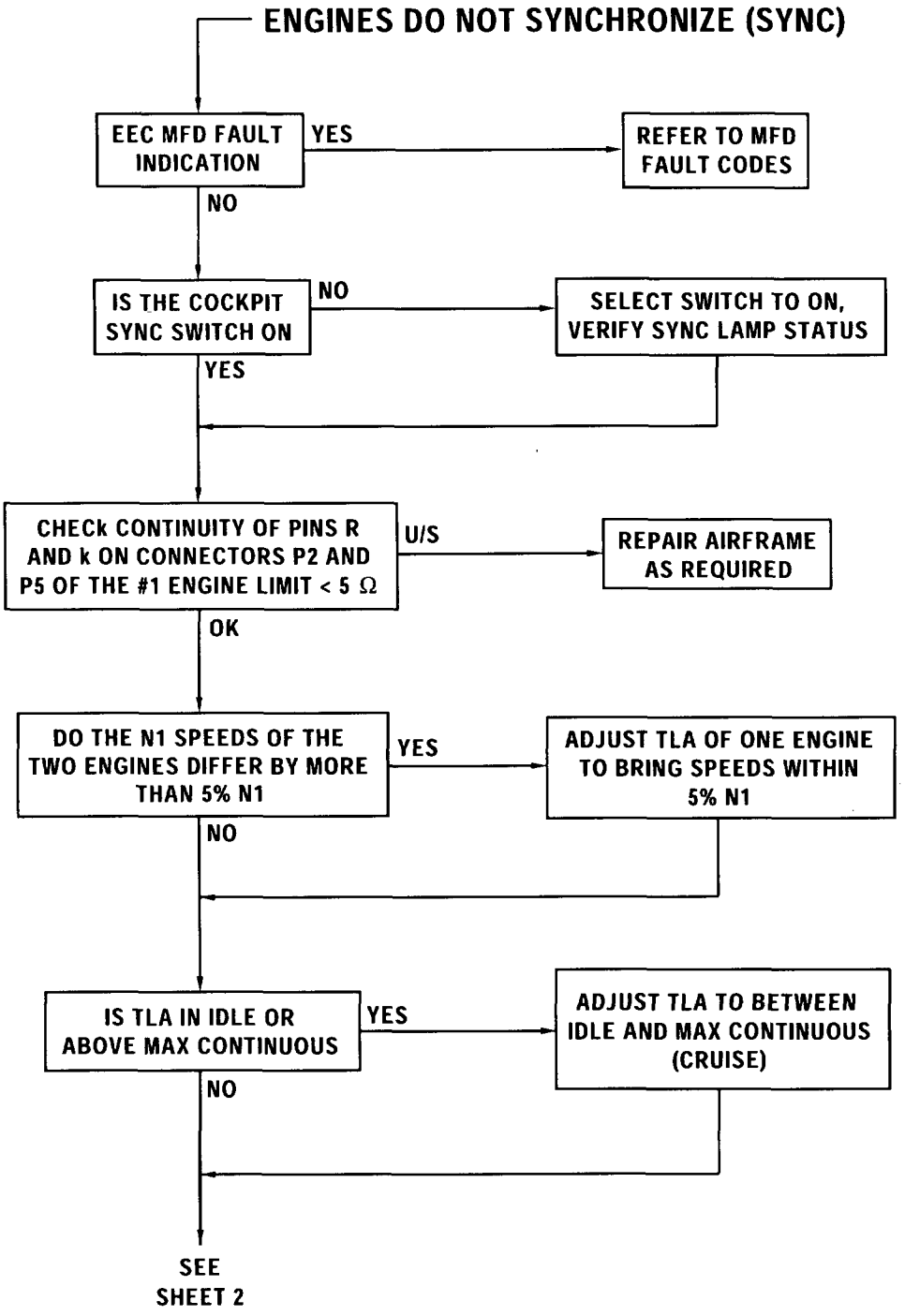
Operating Problems - FADEC Fault Light with no Applicable MFD Code
Figure 121 (Sheet 2)

EXTERNAL ENGINE FUEL SYSTEM LEAKS


IS FUEL LEAKING FROM JOINT OF PIPES?
YES
TIGHTEN FITTING OR REPLACE PACKING AS REQ'D
NO
IS FUEL LEAKING FROM HMU?
YES
IS FUEL LEAKING FROM HMU FUEL / OIL DRAIN?
YES
REPLACE O-RINGS ON FUEL PUMP
NO
NO
IS FUEL LEAKING FROM TORQUE MOTOR?
YES
REPLACE HMU
NO
LOCATE SOURCE OF LEAK AND REPAIR AS REQ'D
IS FUEL LEAKING FROM ECOLOGY TANK DRAIN?
YES
IS FUEL DUMPING FROM START / DUMP VALVE DURING NORMAL RUNNING
YES
REPLACE START / DUMP VALVE
NO
NO
WAS ENGINE SHUT DOWN 3 OR MORE TIMES WITHOUT A MINIMUM OF 10 MIN AT IDLE
NO
LOCATE SOURCE OF LEAK AND REPAIR AS REQ'D
YES
NORMAL OPERATION START ENGINE AND RUN A MINIMUM OF 10 MIN AT IDLE
NOT O/K
REPLACE ECOLOGY TANK
O/K
CONTINUE OPERATION

C33839A

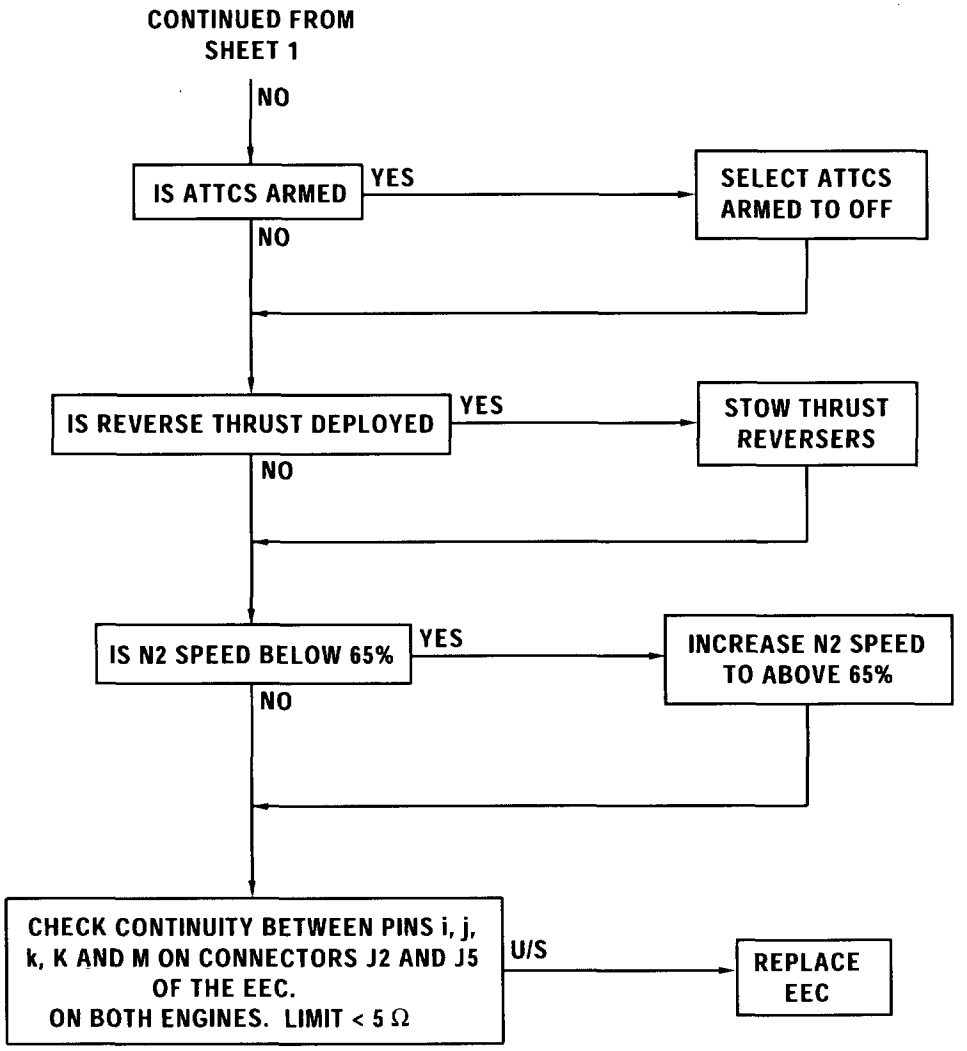
Operating Problems - External Engine Fuel System Leaks
Figure 122


ENGINES DO NOT SYNCHRONIZE (SYNC)
EEC MFD FAULT INDICATION
YES
REFER TO MFD FAULT CODES
NO
IS THE COCKPIT SYNC SWITCH ON
NO
SELECT SWITCH TO ON, VERIFY SYNC LAMP STATUS
YES
CHECk CONTINUITY OF PINS R AND k ON CONNECTORS P2 AND P5 OF THE #1 ENGINE LIMIT < 5 Ω
U/S
REPAIR AIRFRAME AS REQUIRED
OK
DO THE N1 SPEEDS OF THE TWO ENGINES DIFFER BY MORE THAN 5% N1
YES
ADJUST TLA OF ONE ENGINE TO BRING SPEEDS WITHIN 5% N1
NO
IS TLA IN IDLE OR ABOVE MAX CONTINUOUS
YES
ADJUST TLA TO BETWEEN IDLE AND MAX CONTINUOUS (CRUISE)
NO
SEE SHEET 2

Pre-SB24434/Post-SB24514 C33382A

Operating Problems - Engines Do not Sync
Figure 123 (Sheet 1 of 4)

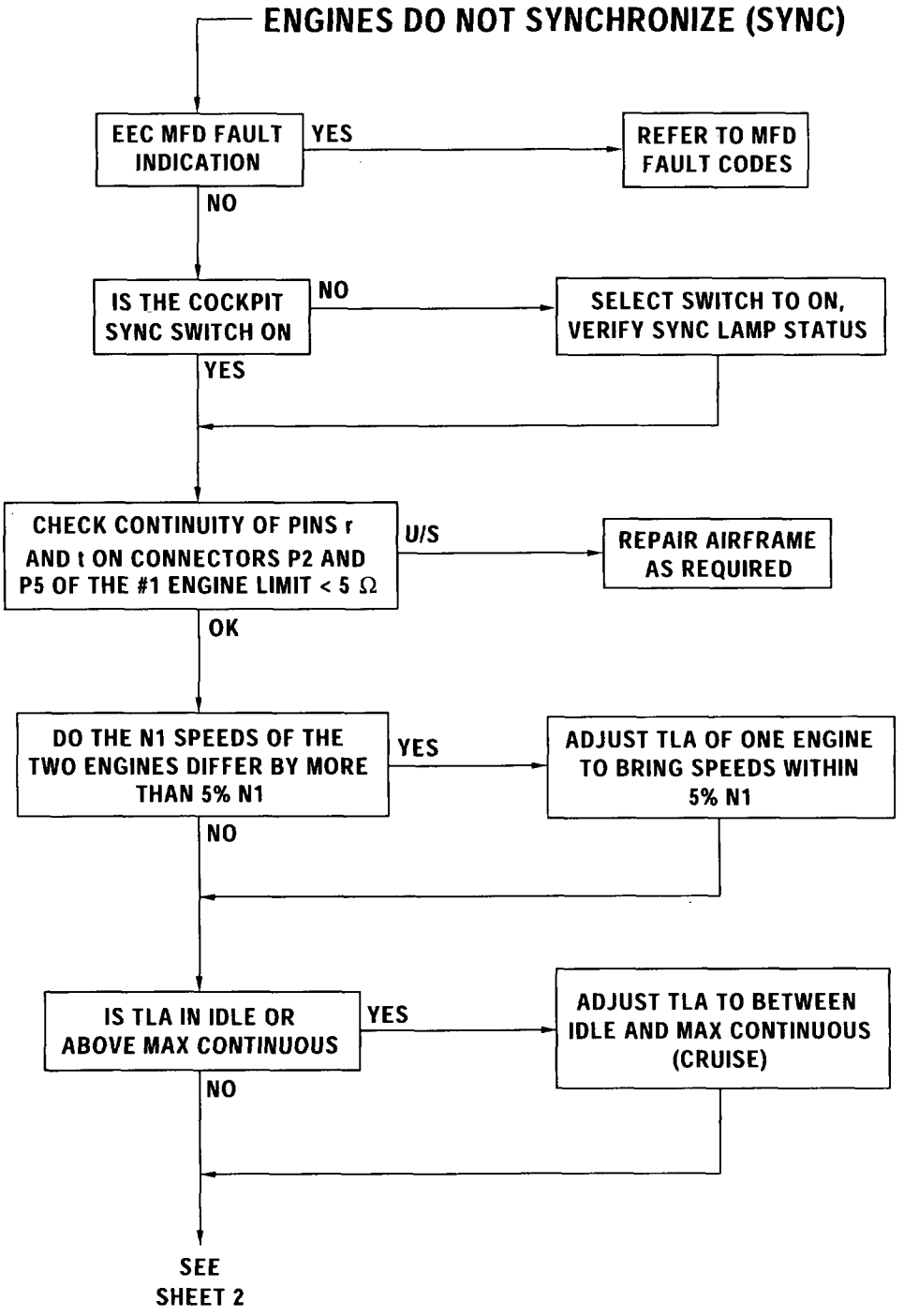
ENGINES DO NOT SYNCHRONIZE (SYNC)



FOR CHANNEL	CHECK CONNECTORS
A	P2, J2
B	P5, J5

Pre-SB24434/Post-SB24514 C33828

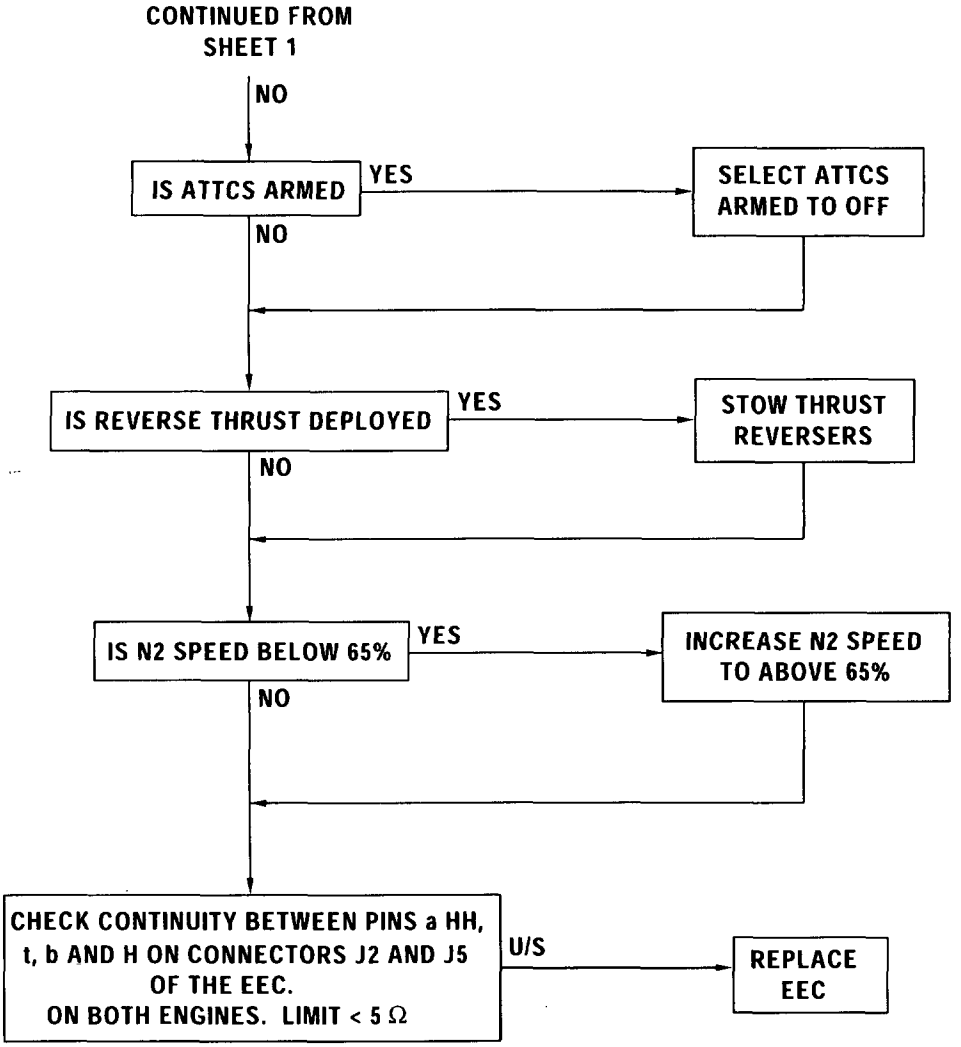
Operating Problems - Engines Do not Sync
Figure 123 (Sheet 2)


ENGINES DO NOT SYNCHRONIZE (SYNC)
EEC MFD FAULT INDICATION
YES
REFER TO MFD FAULT CODES
NO
IS THE COCKPIT SYNC SWITCH ON
NO
SELECT SWITCH TO ON, VERIFY SYNC LAMP STATUS
YES
CHECK CONTINUITY OF PINS r AND t ON CONNECTORS P2 AND P5 OF THE #1 ENGINE LIMIT < 5 Ω
U/S
REPAIR AIRFRAME AS REQUIRED
OK
DO THE N1 SPEEDS OF THE TWO ENGINES DIFFER BY MORE THAN 5% N1
YES
ADJUST TLA OF ONE ENGINE TO BRING SPEEDS WITHIN 5% N1
NO
IS TLA IN IDLE OR ABOVE MAX CONTINUOUS
YES
ADJUST TLA TO BETWEEN IDLE AND MAX CONTINUOUS (CRUISE)
NO
SEE SHEET 2

Post-SB24434/Pre-SB24514 C64067

Operating Problems - Engines Do not Sync
Figure 123 (Sheet 3)

ENGINES DO NOT SYNCHRONIZE (SYNC)



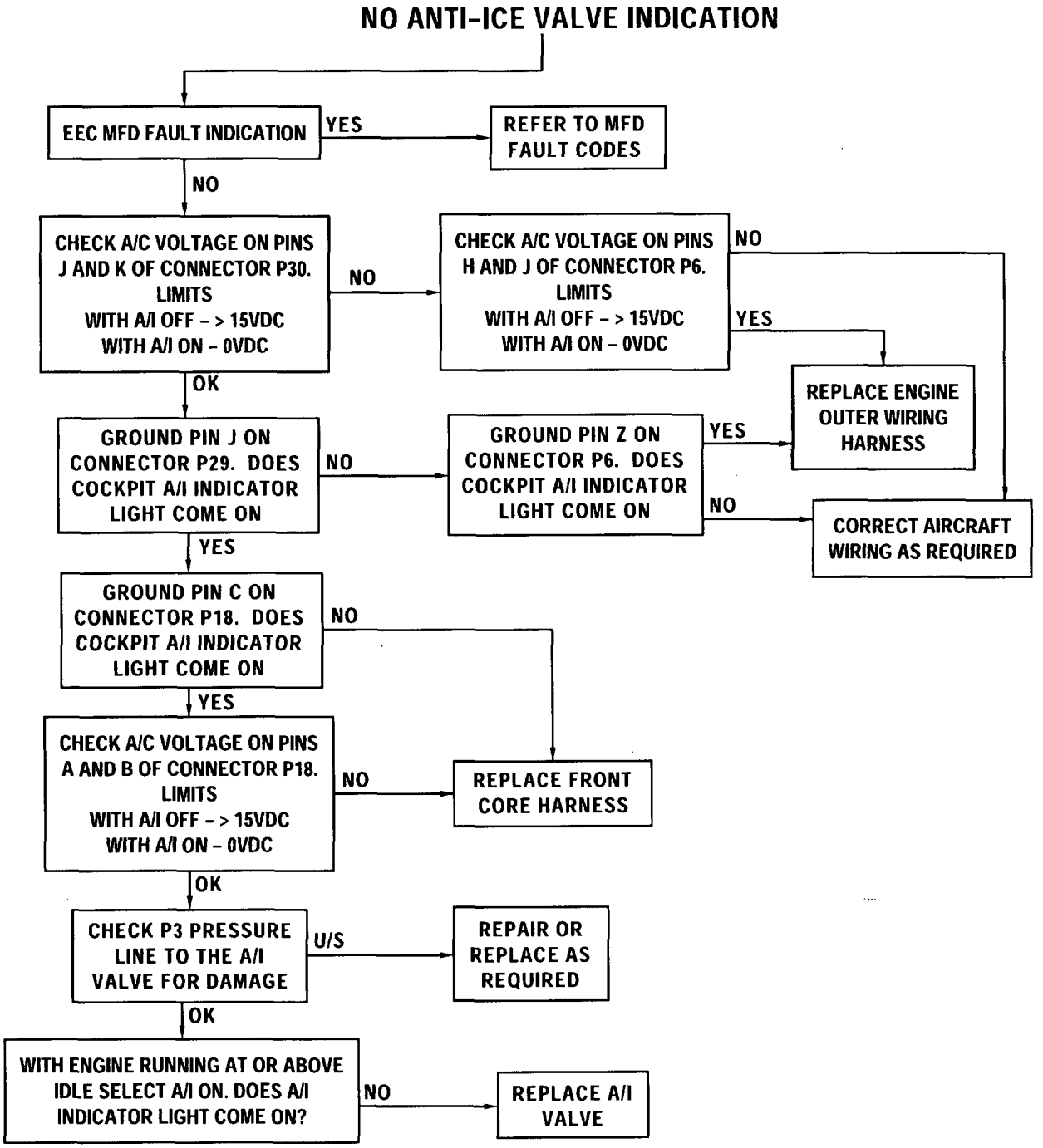
FOR CHANNEL	CHECK CONNECTORS
A	P2, J2
B	P5, J5

I

Post-SB24434/Pre-SB24514

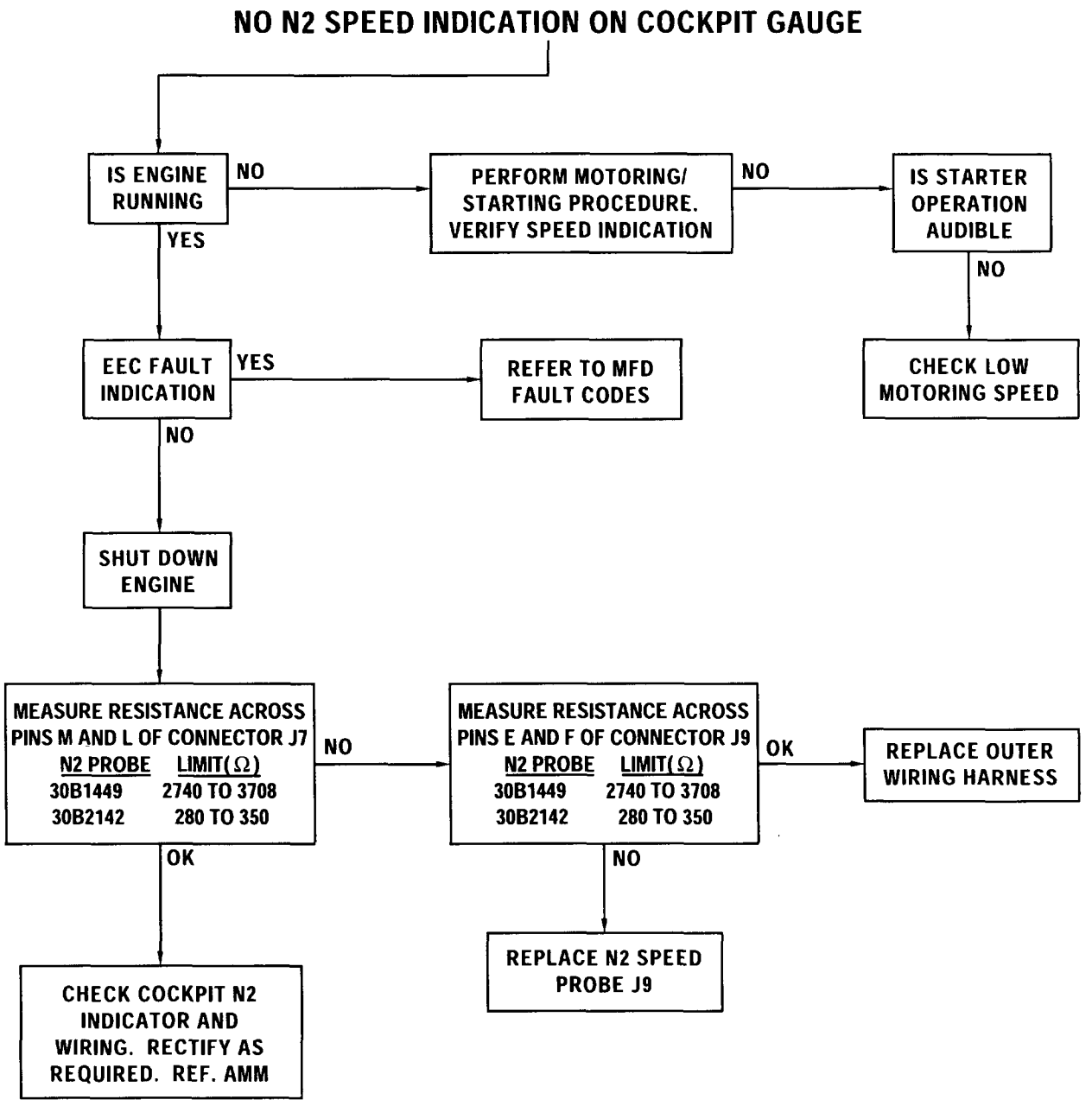
C64080

Operating Problems - Engines Do not Sync
Figure 123 (Sheet 4)


NO ANTI-ICE VALVE INDICATION
EEC MFD FAULT INDICATION
YES
REFER TO MFD FAULT CODES
NO
CHECK A/C VOLTAGE ON PINS J AND K OF CONNECTOR P30. LIMITS WITH A/I OFF - > 15VDC WITH A/I ON - 0VDC
NO
CHECK A/C VOLTAGE ON PINS H AND J OF CONNECTOR P6. LIMITS WITH A/I OFF - > 15VDC WITH A/I ON - 0VDC
NO
YES
REPLACE ENGINE OUTER WIRING HARNESS
OK
GROUND PIN J ON CONNECTOR P29. DOES COCKPIT A/I INDICATOR LIGHT COME ON
NO
GROUND PIN Z ON CONNECTOR P6. DOES COCKPIT A/I INDICATOR LIGHT COME ON
YES
NO
CORRECT AIRCRAFT WIRING AS REQUIRED
YES
GROUND PIN C ON CONNECTOR P18. DOES COCKPIT A/I INDICATOR LIGHT COME ON
NO
YES
CHECK A/C VOLTAGE ON PINS A AND B OF CONNECTOR P18. LIMITS WITH A/I OFF - > 15VDC WITH A/I ON - 0VDC
NO
REPLACE FRONT CORE HARNESS
OK
CHECK P3 PRESSURE LINE TO THE A/I VALVE FOR DAMAGE
U/S
REPAIR OR REPLACE AS REQUIRED
OK
WITH ENGINE RUNNING AT OR ABOVE IDLE SELECT A/I ON. DOES A/I INDICATOR LIGHT COME ON?
NO
REPLACE A/I VALVE

C33383A

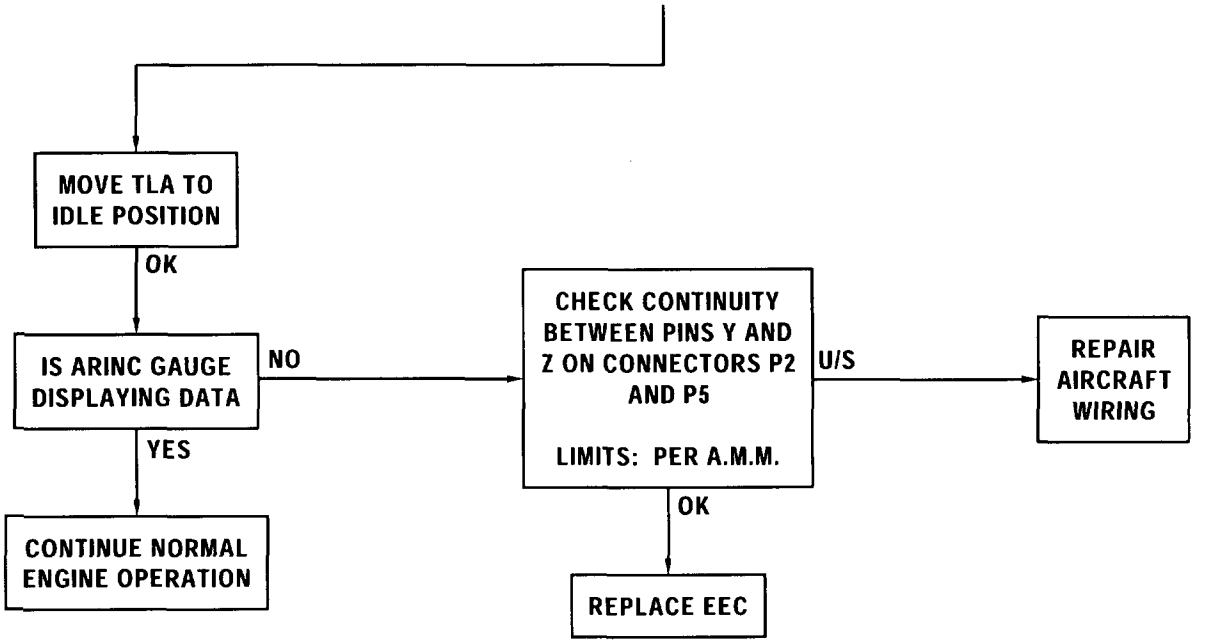
Operating Problems - No Anti-ice Valve Indication
Figure 124



C33414A

Operating Problems - No N2 Speed Indication
Figure 125

NO T45 AND MFD CODE INDICATION

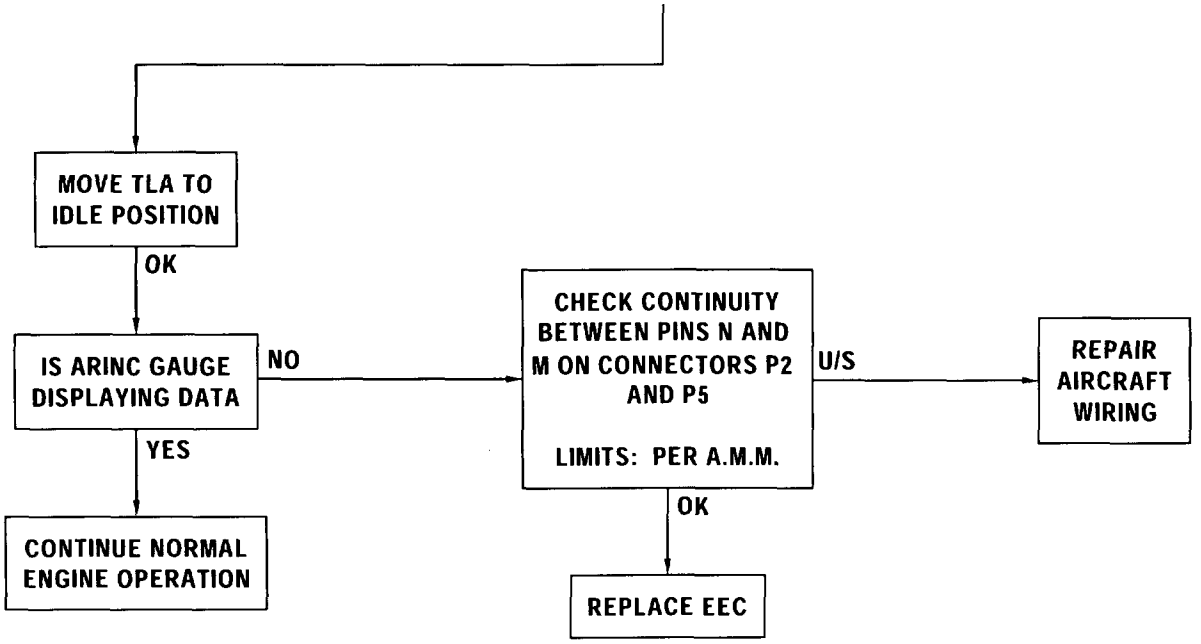


FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

Pre-SB24434/Post-SB24514 C33840

Operating Problems - No T45 or MFD Code Indication
Figure 126 (Sheet 1 of 2)

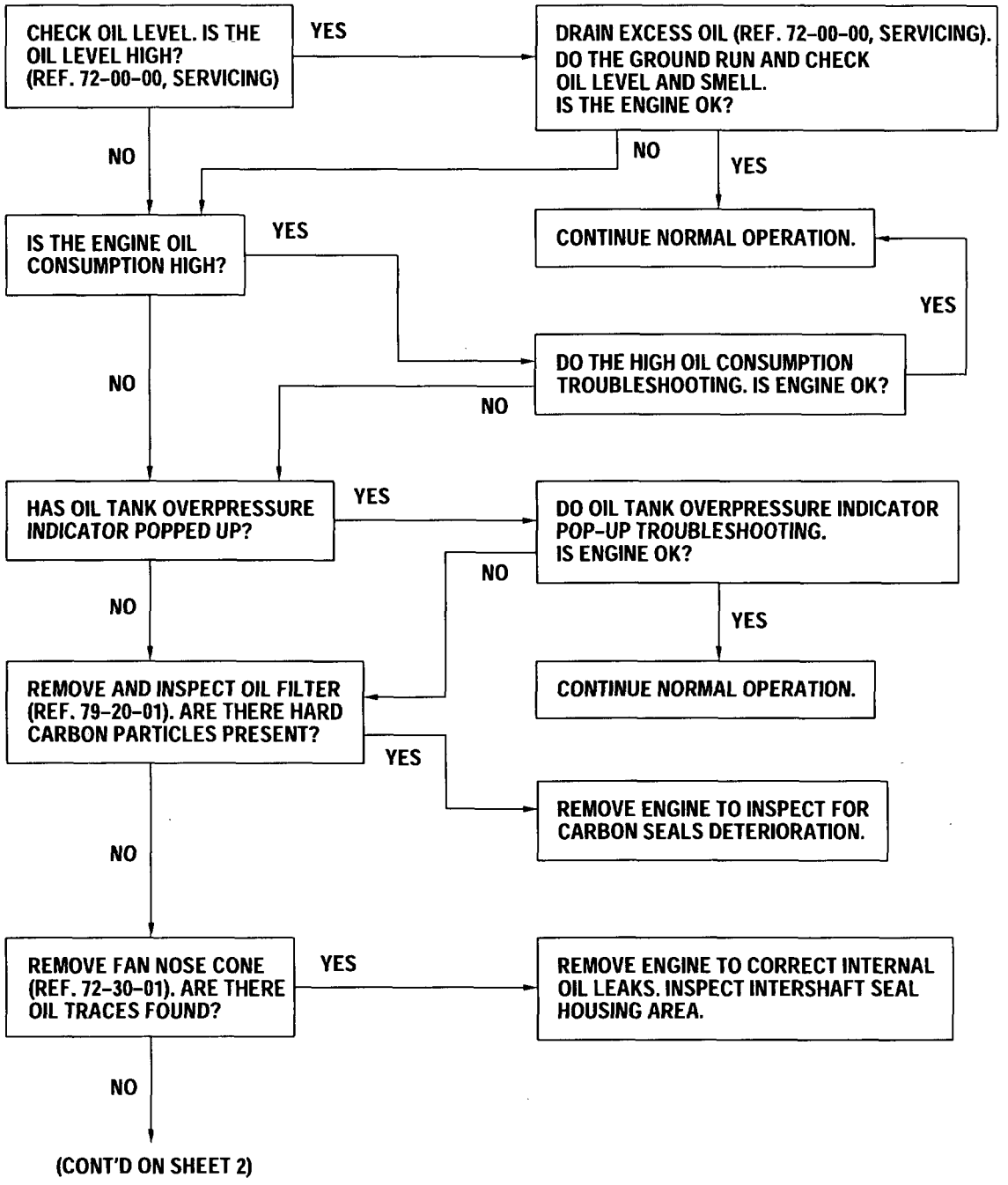
NO T45 AND MFD CODE INDICATION



FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

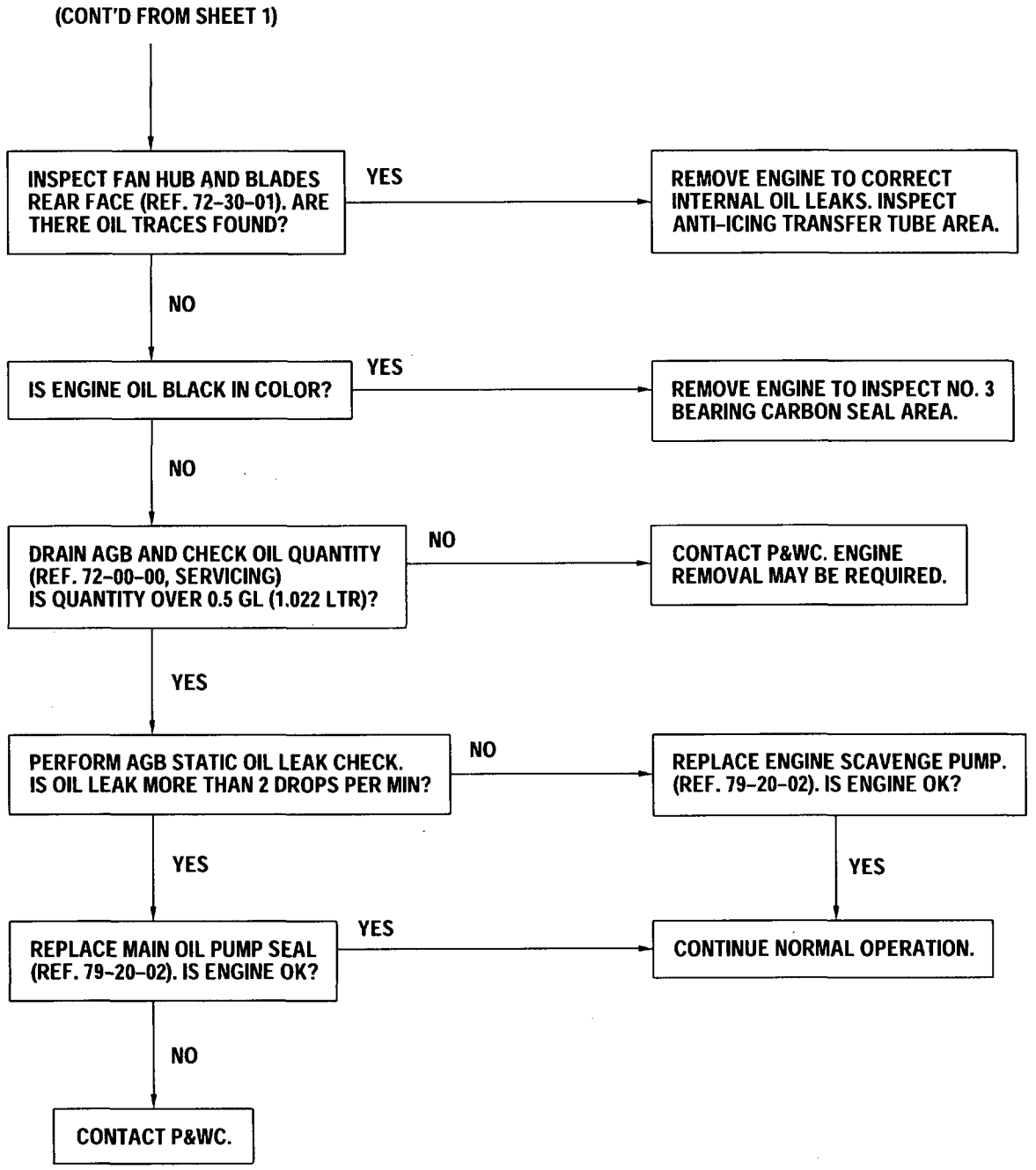
I **Post-SB24434/Pre-SB24514** C64081

Operating Problems - No T45 or MFD Code Indication
Figure 126 (Sheet 2)


CHECK OIL LEVEL. IS THE OIL LEVEL HIGH? (REF. 72-00-00, SERVICING)
YES
DRAIN EXCESS OIL (REF. 72-00-00, SERVICING). DO THE GROUND RUN AND CHECK OIL LEVEL AND SMELL. IS THE ENGINE OK?
NO
YES
NO
IS THE ENGINE OIL CONSUMPTION HIGH?
YES
CONTINUE NORMAL OPERATION.
YES
NO
DO THE HIGH OIL CONSUMPTION TROUBLESHOOTING. IS ENGINE OK?
NO
HAS OIL TANK OVERPRESSURE INDICATOR POPPED UP?
YES
DO OIL TANK OVERPRESSURE INDICATOR POP-UP TROUBLESHOOTING. IS ENGINE OK?
NO
NO
YES
REMOVE AND INSPECT OIL FILTER (REF. 79-20-01). ARE THERE HARD CARBON PARTICLES PRESENT?
CONTINUE NORMAL OPERATION.
YES
REMOVE ENGINE TO INSPECT FOR CARBON SEALS DETERIORATION.
NO
REMOVE FAN NOSE CONE (REF. 72-30-01). ARE THERE OIL TRACES FOUND?
YES
REMOVE ENGINE TO CORRECT INTERNAL OIL LEAKS. INSPECT INTERSHAFT SEAL HOUSING AREA.
NO
(CONT'D ON SHEET 2)

C126721

Operating Problems - Oil Smell or Smoke in the Cabin
Figure 127 (Sheet 1 of 2)


(CONT'D FROM SHEET 1)
INSPECT FAN HUB AND BLADES REAR FACE (REF. 72-30-01). ARE THERE OIL TRACES FOUND?
YES
REMOVE ENGINE TO CORRECT INTERNAL OIL LEAKS. INSPECT ANTI-ICING TRANSFER TUBE AREA.
NO
IS ENGINE OIL BLACK IN COLOR?
YES
REMOVE ENGINE TO INSPECT NO. 3 BEARING CARBON SEAL AREA.
NO
DRAIN AGB AND CHECK OIL QUANTITY (REF. 72-00-00, SERVICING) IS QUANTITY OVER 0.5 GL (1.022 LTR)?
NO
CONTACT P&WC. ENGINE REMOVAL MAY BE REQUIRED.
YES
PERFORM AGB STATIC OIL LEAK CHECK. IS OIL LEAK MORE THAN 2 DROPS PER MIN?
NO
REPLACE ENGINE SCAVENGE PUMP. (REF. 79-20-02). IS ENGINE OK?
YES
YES
REPLACE MAIN OIL PUMP SEAL (REF. 79-20-02). IS ENGINE OK?
YES
CONTINUE NORMAL OPERATION.
NO
CONTACT P&WC.

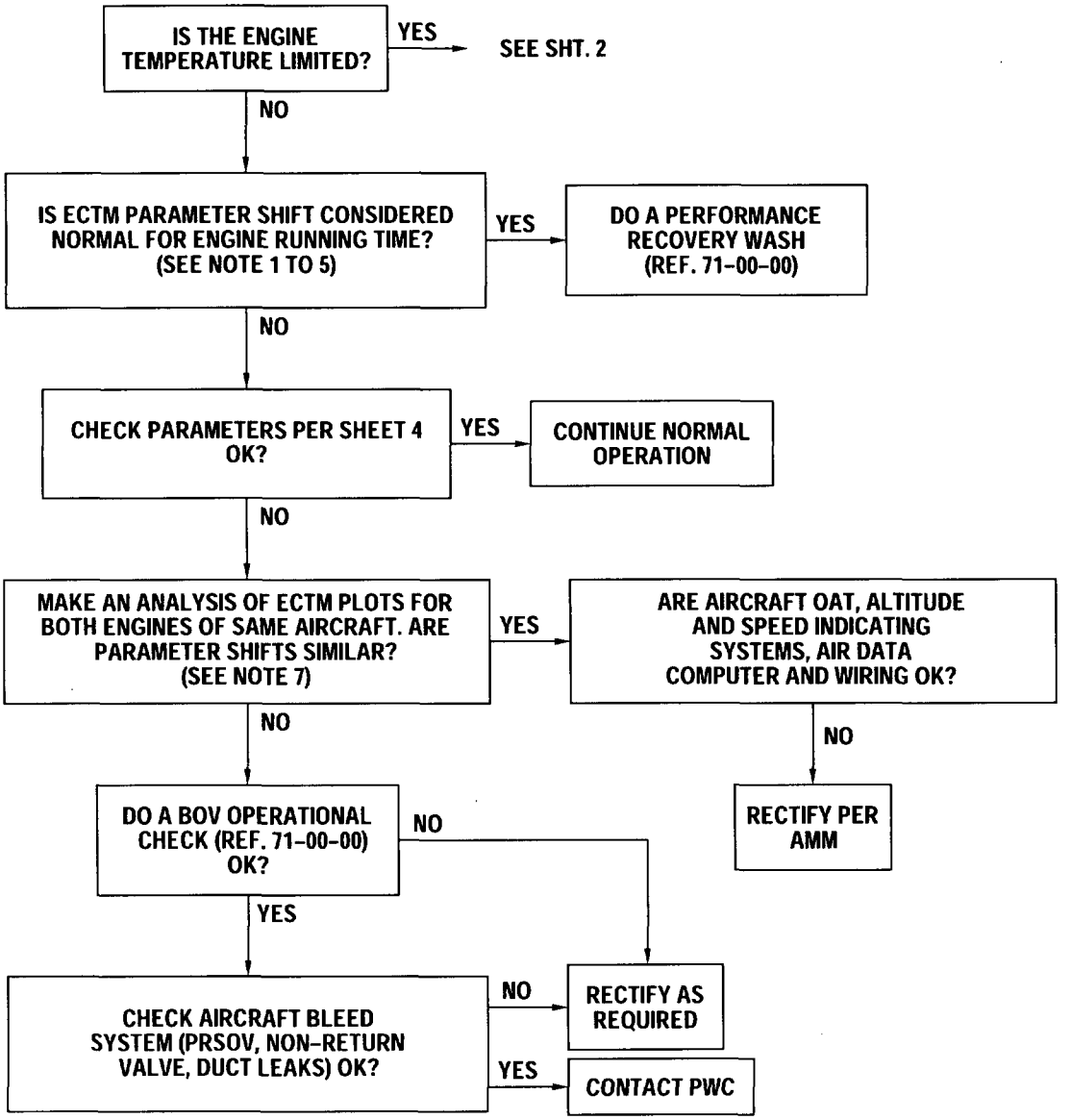
C126723

Operating Problems - Oil Smell or Smoke in the Cabin
Figure 127 (Sheet 2)

ENGINE PERFORMANCE DETERIORATION

SYMPTOMS
ECTM PARAMETER SHIFT
ENGINE ITT/T45 TEMPERATURE LIMITED

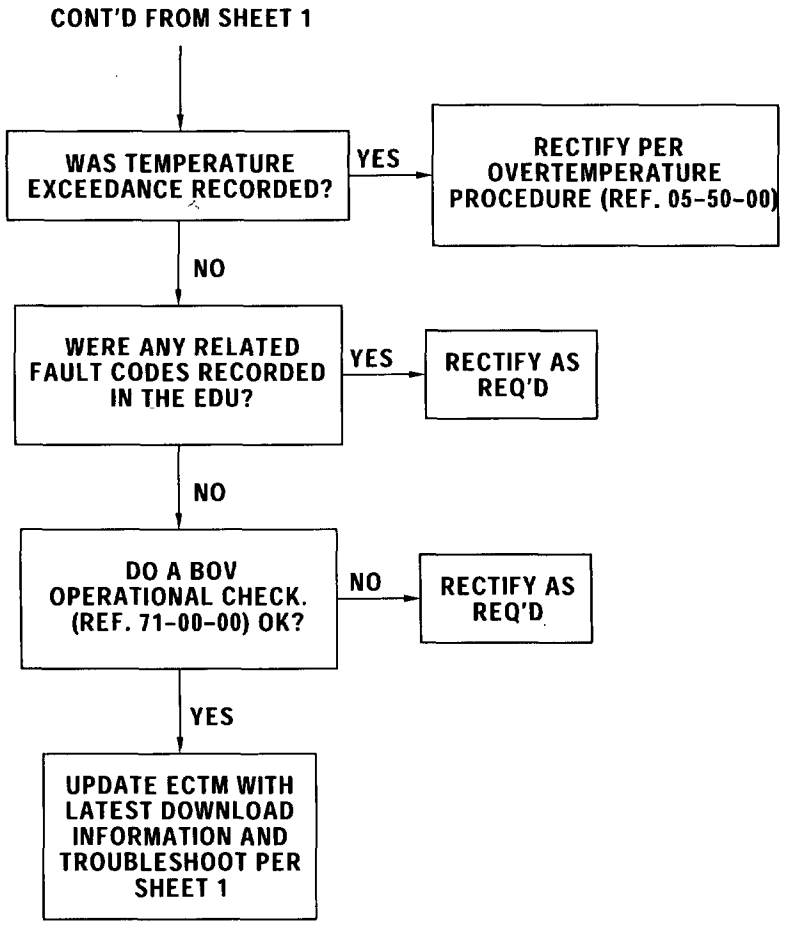
SUSPECT LRU
1. ENGINE BLEED VALVES AND SOLENOIDS
2. AIRCRAFT AIR BLEED SYSTEM
3. ENGINE ITT/T45 INDICATING SYSTEM
4. AIR DATA COMPUTER
5. ENGINE


IS THE ENGINE TEMPERATURE LIMITED?
YES
SEE SHT. 2
NO
IS ECTM PARAMETER SHIFT CONSIDERED NORMAL FOR ENGINE RUNNING TIME? (SEE NOTE 1 TO 5)
YES
DO A PERFORMANCE RECOVERY WASH (REF. 71-00-00)
NO
CHECK PARAMETERS PER SHEET 4 OK?
YES
CONTINUE NORMAL OPERATION
NO
MAKE AN ANALYSIS OF ECTM PLOTS FOR BOTH ENGINES OF SAME AIRCRAFT. ARE PARAMETER SHIFTS SIMILAR? (SEE NOTE 7)
YES
ARE AIRCRAFT OAT, ALTITUDE AND SPEED INDICATING SYSTEMS, AIR DATA COMPUTER AND WIRING OK?
NO
NO
RECTIFY PER AMM
DO A BOV OPERATIONAL CHECK (REF. 71-00-00) OK?
NO
YES
CHECK AIRCRAFT BLEED SYSTEM (PRSOV, NON-RETURN VALVE, DUCT LEAKS) OK?
NO
RECTIFY AS REQUIRED
YES
CONTACT PWC

C92069

Operating Problems - Engine Performance Deterioration
Figure 128 (Sheet 1 of 4)

ENGINE PERFORMANCE DETERIORATION (cont'd)



C92071

Operating Problems - Engine Performance Deterioration
Figure 128 (Sheet 2)

ENGINE PERFORMANCE DETERIORATION

ENGINE PARAMETERS			PROBABLE CONDITION	ACTION REQUIRED	REMARKS
ITT/T4.5	N2	WF			
↑	↑	↑	AIRCRAFT/ENGINE N1 INDICATING SYSTEM.	INSPECT/REPAIR	
			COMPRESSOR FOD, RUB.	BORESCOPE INSPECT	REMOVE ENGINE IF FOD EXCEED LIMITS
			COMPRESSOR CONTAMINATION.	PERF.RECOVERY WASH	
↓	↓	↓	AIRCRAFT/ENGINE N1 INDICATING SYSTEM	INSPECT/REPAIR	-
↑ OR ↓	-	-	AIRCRAFT/ENGINE ITT/T4.5 INDICATING SYSTEM (SEE NOTE 8)	INSPECT/REPAIR	ITT/T4.5 USUALLY DECREASES WHEN PROBES UNSERVICEABLE
-	↑ OR ↓	-	AIRCRAFT/ENGINE N2 INDICATING SYSTEM.	INSPECT/REPAIR	
		↑ OR ↓	AIRCRAFT/ENGINE WF INDICATING SYSTEM.	INSPECT/REPAIR	-
↑	↑	↑	ANTI-ICING VALVE SEIZED OPEN.	INSPECT/REPAIR	-
			P2.5 AIR LEAKS FROM ENGINE/AIRFRAME SYSTEM.		
			LP TURBINE STATOR VANES BURNED/FLOW AREA INCREASED.	BORESCOPE LP STATOR VANES & LP BLADES	THIS IS LESS PROBABLE REPAIR LP MODULE.
			LP TURBINE BLADE TIP OXIDATION/RUB.		
			INTERCOMPRESSOR BLEED VALVE SEIZED IN OPEN POSITION.	CHECK VALVE	-
↑	↓	↑	HP TURBINE VANE SEGMENTS BURNED/FLOW AREA INCREASED.	BORESCOPE HP VANE SEGMENTS AND BLADES	IF LIMITS EXCEEDED DO AN HSI.
			HPT BLADE TIP OXIDATION/RUB/DAMAGE		
			STANDARD HOT SECTION DETERIORATION.	DO AN HSI IF ITT/T4.5 LIMIT IS EXCEEDED	-
↑	-	↑	GAS GENERATOR CASE CRACKED AT FUEL NOZZLE OR P3 BLEED BOSS.	CHECK	REPLACE ENGINE IF DAMAGE IS CONFIRMED
			LEAKING GAS GENERATOR DRAIN VALVE.	INSPECT/REPLACE	-

C75112B

Operating Problems - Engine Performance Deterioration
Figure 128 (Sheet 3)

ENGINE PERFORMANCE DETERIORATION

NOTES:

1. HOT SECTION COMPONENTS AND PERFORMANCE GRADUALLY DETERIORATE AS RUNNING TIME ACCUMULATES. THE DETERIORATION RATE VARIES ACCORDING TO OPERATING CONDITIONS (ENVIRONMENT AND TYPE OF OPERATION) AND FOR DIFFERENT ENGINE MODIFICATION STANDARDS. IF ENGINE PERFORMANCE APPARENTLY IMPROVES (WITHOUT MAINTENANCE ACTION) CHECK PARAMETER INDICATING SYSTEMS (USUALLY ITT/T4.5 SYSTEM IS AT FAULT).

2. IN GENERAL, A GRADUAL INCREASE IN ITT/T4.5 OF LESS THAN 10 °C OVER 1000 FH IS CONSIDERED NORMAL DETERIORATION.

3. A RAPID SHIFT IN ENGINE PARAMETERS IS USUALLY THE RESULT OF AN INDICATING SYSTEM DAMAGE (REFER TO SHEETS 4 AND 5 FOR TROUBLESHOOTING RECOMMENDATIONS) EXCEPT WHEN A BURNED HP VANE INCREASES THE FLOW AREA WHICH MAY PRODUCE A RAPID N2 DECREASE WITH LITTLE IMPACT ON ITT(T4.5).

4. A SUDDEN, POSITIVE CHANGE IN ITT/T4.5 SLOPE, RESULTING IN ITT CHANGES OF 5 °C OR MORE, OVER 100 FH SHOULD BE INVESTIGATED. DO A BORESCOPE INSPECTION OF THE FIRST-STAGE HP TURBINE.

5. A STEP CHANGE IN ITT/T4.5 OF 5 °C OR MORE THAT CONTINUES FOR AT LEAST 20FH SHOULD BE INVESTIGATED. DO A BORESCOPE INSPECTION OF THE FIRST-STAGE HP TURBINE.

6. FOR EVERY 20 TO 30 °C (35-55 °F) INCREASE IN ITT/T4.5 OR A 1 TO 1.5% DECREASE IN N2 DO A BORESCOPE INSPECTION OF THE COMBUSTION CHAMBER, HP TURBINE VANE SEGMENTS AND HP TURBINE BLADES.
   IN ADDITION, DO A PERFORMANCE RECOVERY WASH.

7. A DAMAGE IN THE OAT, AIRCRAFT SPEED OR ALTITUDE INDICATING SYSTEM WILL CAUSE A SIMILAR ECTM SHIFT ON BOTH ENGINES INSTALLED IN THE SAME AIRCRAFT.

8. A SIGNIFICANT DIFFERENCE BETWEEN ECTM AND POWER ASSURANCE CHECK PARAMETER VALUES INDICATES THAT THE DAMAGE IS WITHIN THE AIRCRAFT AIR BLEED SYSTEM ASSOCIATED WITH THE AFFECTED ENGINE (ENGINE BLEED IS OFF DURING A POWER ASSURANCE CHECK).

10. TO REMOVE DOUBTS, A T4.5 SYSTEM CHECK AND A POWER ASSURANCE CHECK WITH THE AIR BLEED PORTS BLANKED-OFF IS RECOMMENDED BEFORE ENGINE REMOVAL.

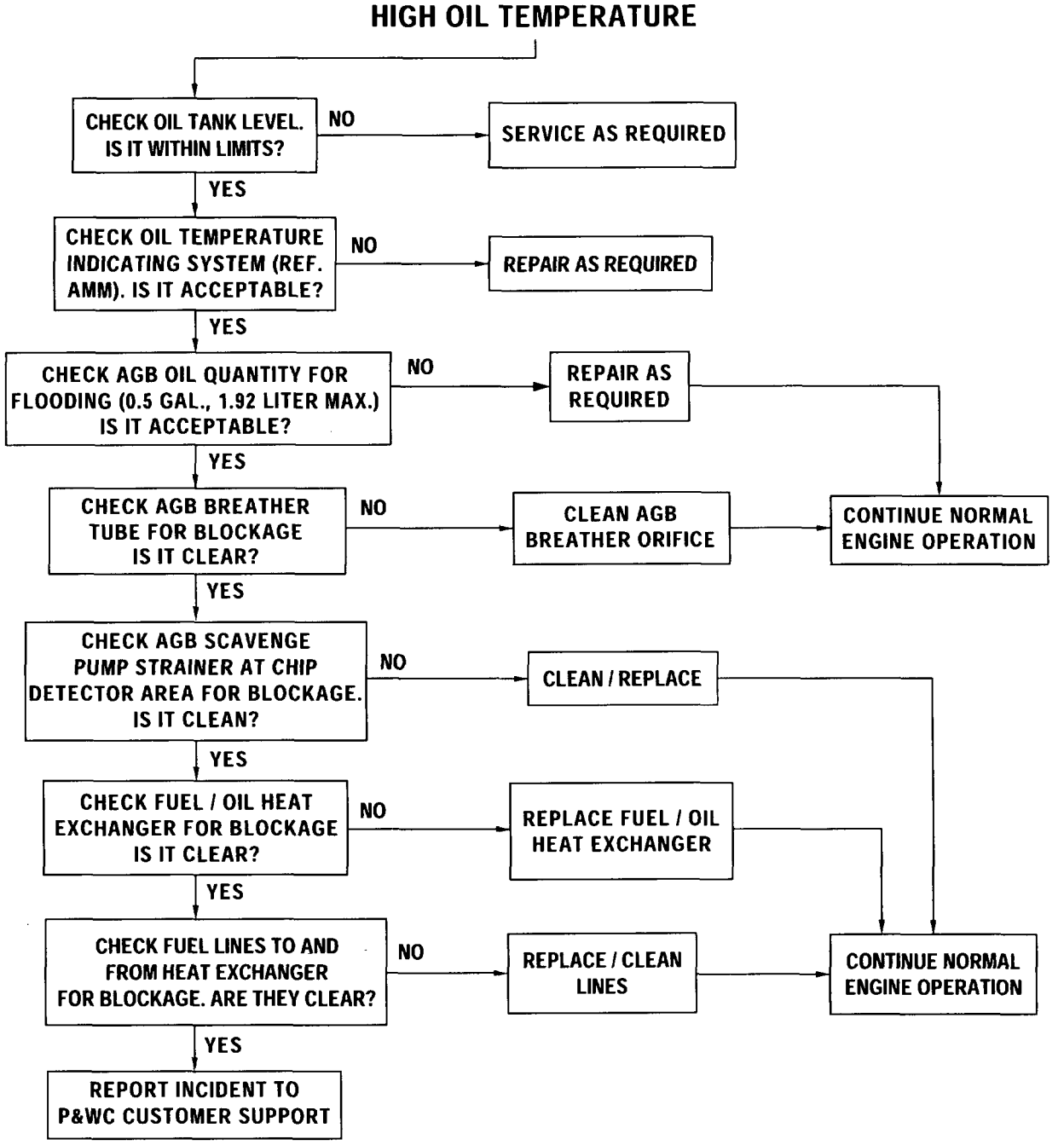
11. WHEN AN ENGINE IS T4.5 LIMITED ON CLIMB OR CRUISE AND THE POWER ASSURANCE CHECK IS SATISFACTORY, THE DAMAGE IS WITHIN THE AIRCRAFT BLEED SYSTEM ASSOCIATED WITH THE AFFECTED ENGINE.

12. AN INCREASE IN ITT/T4.5 TEMPERATURE WITHOUT OTHER PARAMETER CHANGES MAY BE THE RESULT OF DAMAGED FUEL NOZZLES ALTERING COMBUSTION AND CHANGING THE T4.5 TEMPERATURE DISTRIBUTION.

13. THE TREND MONITORING PROGRAM IS THE MAIN TOOL FOR HEALTH MONITORING OF PW306 ENGINES. CHANGES OF ENGINE PARAMETERS LIKE N2 WF AND ITT/T4.5 MAY INDICATE THAT THE CONDITION OF THE INTERNAL ENGINE COMPONENTS HAVE DETERIORATED. BORESCOPE INSPECTION IS THEN RECOMMENDED IN ORDER TO DETERMINE WHETHER COMPONENT DETERIORATION EXCEEDS LIMITS (REF. INSPECTION/CHECK).

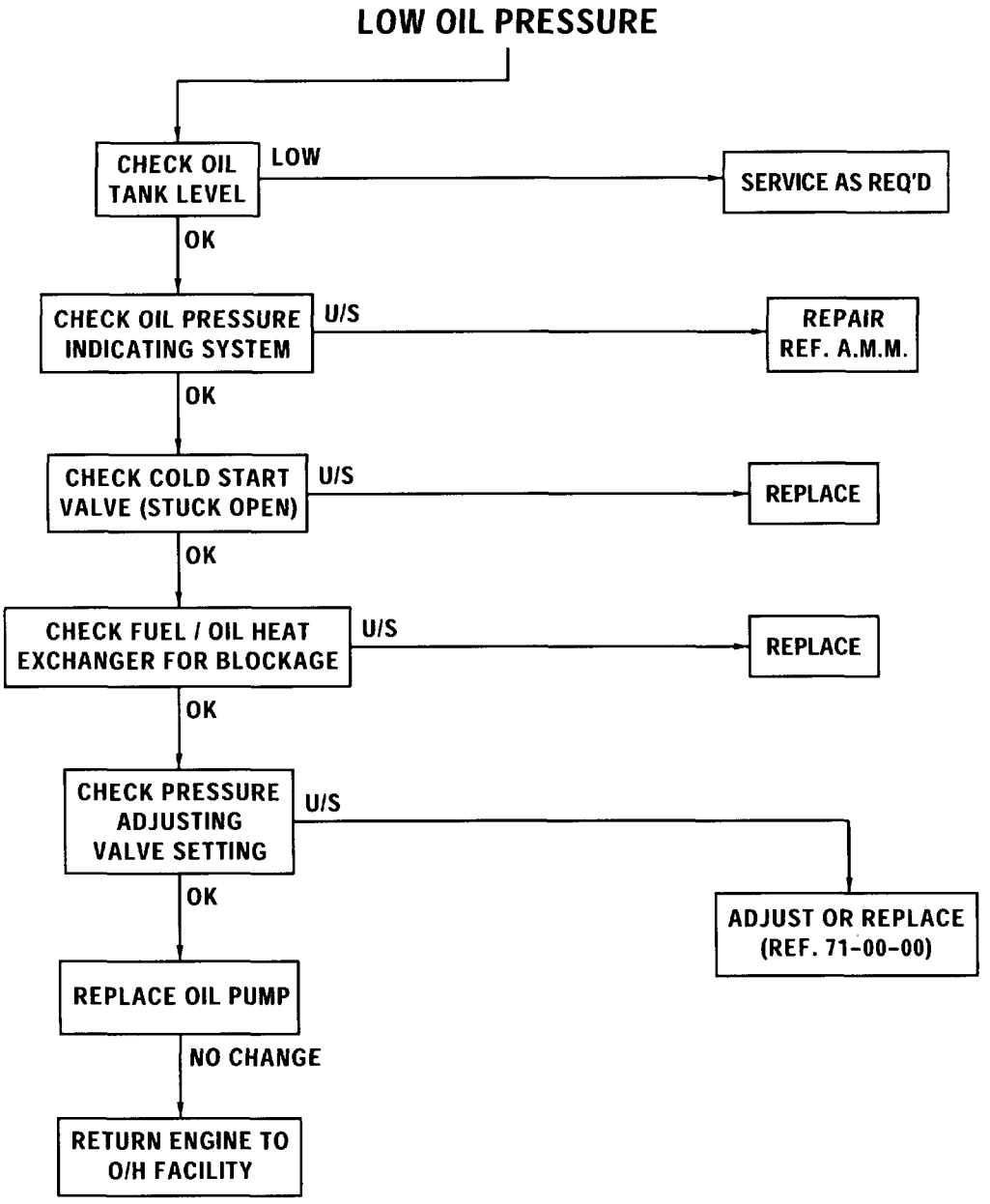
C75113B

Operating Problems - Engine Performance Deterioration
Figure 128 (Sheet 4)


HIGH OIL TEMPERATURE
CHECK OIL TANK LEVEL. IS IT WITHIN LIMITS?
NO
SERVICE AS REQUIRED
YES
CHECK OIL TEMPERATURE INDICATING SYSTEM (REF. AMM). IS IT ACCEPTABLE?
NO
REPAIR AS REQUIRED
YES
CHECK AGB OIL QUANTITY FOR FLOODING (0.5 GAL., 1.92 LITER MAX.) IS IT ACCEPTABLE?
NO
REPAIR AS REQUIRED
YES
CHECK AGB BREATHER TUBE FOR BLOCKAGE IS IT CLEAR?
NO
CLEAN AGB BREATHER ORIFICE
CONTINUE NORMAL ENGINE OPERATION
YES
CHECK AGB SCAVENGE PUMP STRAINER AT CHIP DETECTOR AREA FOR BLOCKAGE. IS IT CLEAN?
NO
CLEAN / REPLACE
YES
CHECK FUEL / OIL HEAT EXCHANGER FOR BLOCKAGE IS IT CLEAR?
NO
REPLACE FUEL / OIL HEAT EXCHANGER
YES
CHECK FUEL LINES TO AND FROM HEAT EXCHANGER FOR BLOCKAGE. ARE THEY CLEAR?
NO
REPLACE / CLEAN LINES
CONTINUE NORMAL ENGINE OPERATION
YES
REPORT INCIDENT TO P&WC CUSTOMER SUPPORT

C32172C

Lubrication Problems - High Oil Temperature
Figure 129

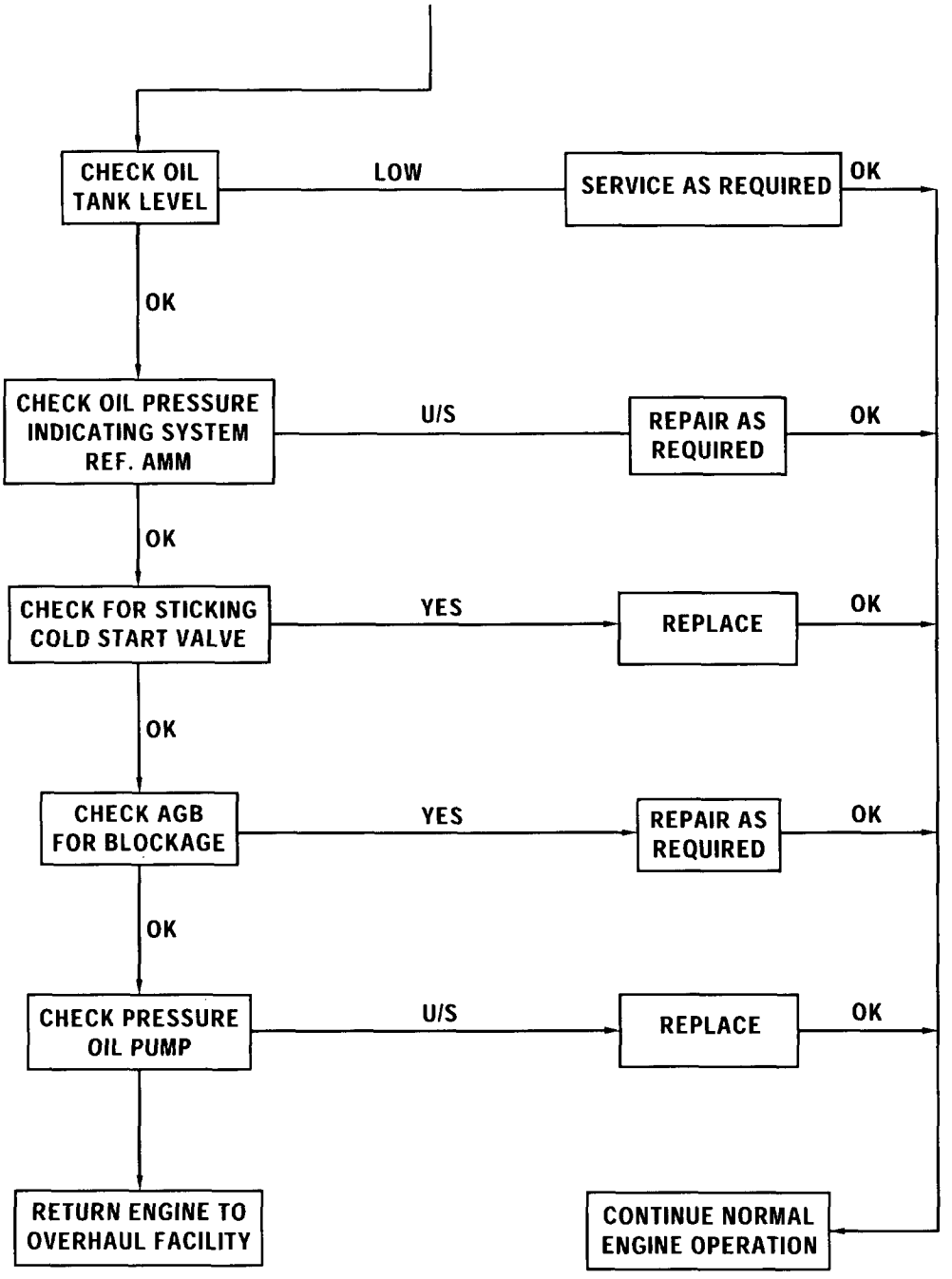


C32220B

Lubrication Problems - Low Oil Pressure
Figure 130

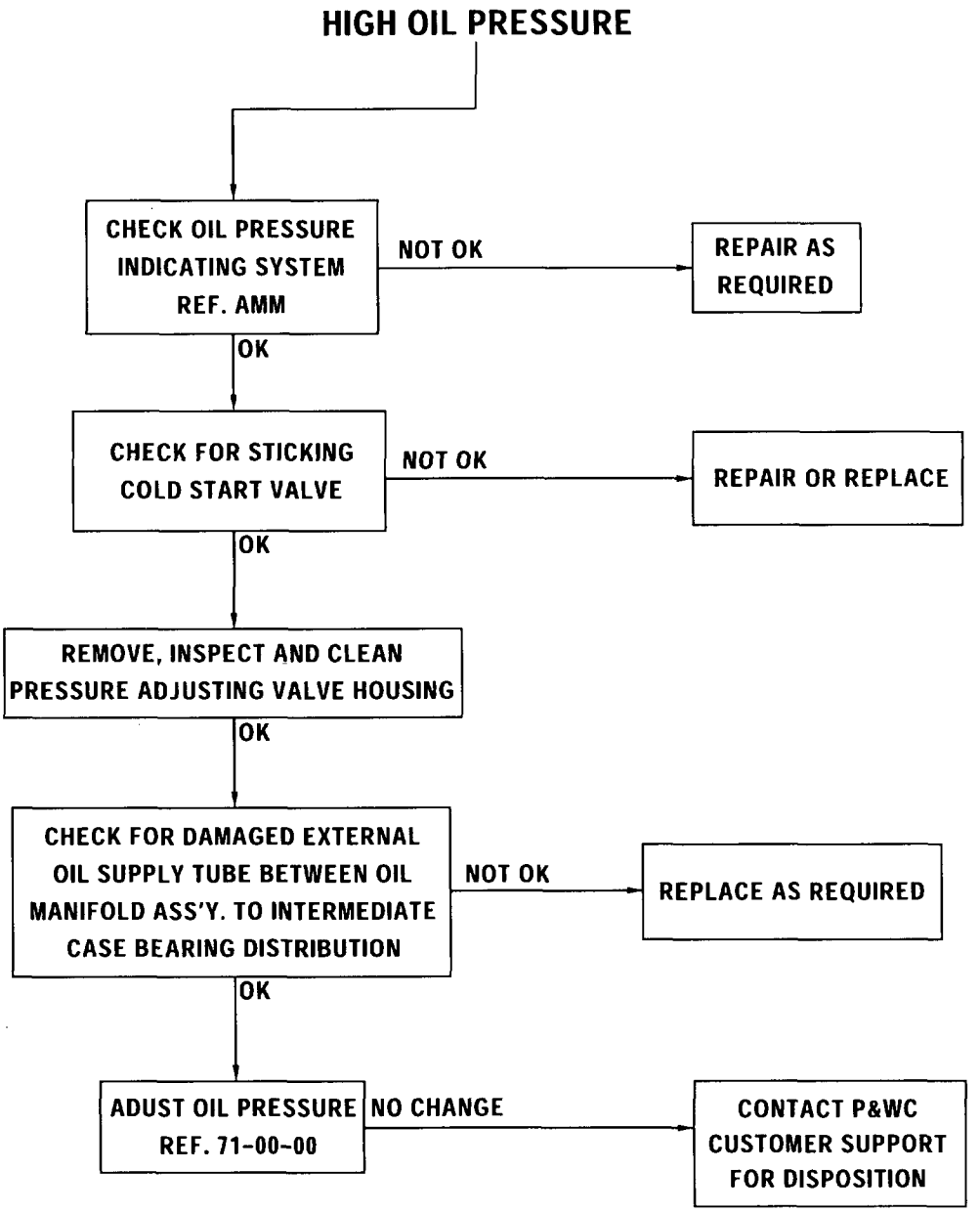
FLUCTUATING OIL PRESSURE

(AT CONSTANT N2)



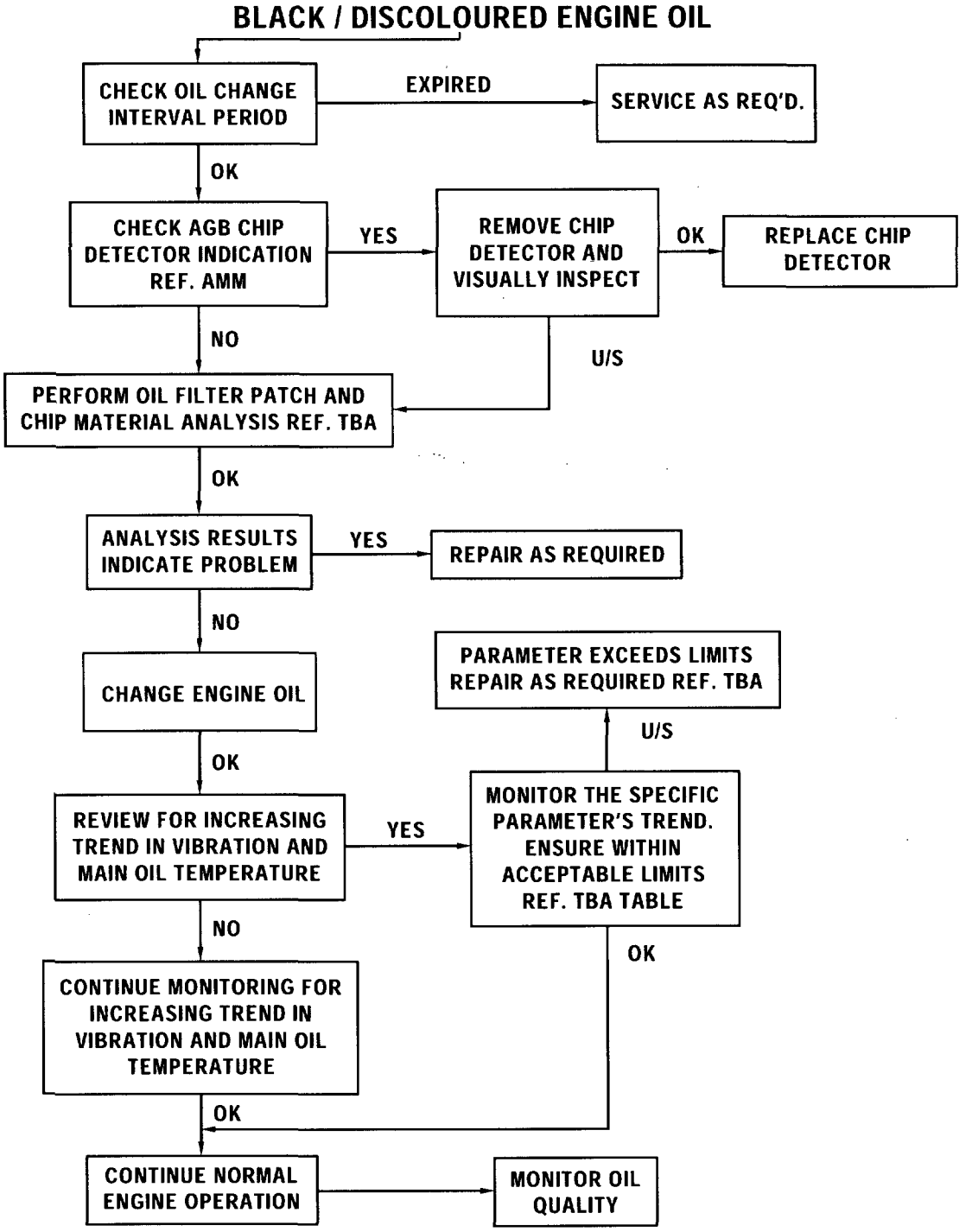
C32171A

Lubrication Problems - Fluctuating Oil Pressure
Figure 131


HIGH OIL PRESSURE
CHECK OIL PRESSURE INDICATING SYSTEM REF. AMM
NOT OK
REPAIR AS REQUIRED
OK
CHECK FOR STICKING COLD START VALVE
NOT OK
REPAIR OR REPLACE
OK
REMOVE, INSPECT AND CLEAN PRESSURE ADJUSTING VALVE HOUSING
OK
CHECK FOR DAMAGED EXTERNAL OIL SUPPLY TUBE BETWEEN OIL MANIFOLD ASS'Y. TO INTERMEDIATE CASE BEARING DISTRIBUTION
NOT OK
REPLACE AS REQUIRED
OK
ADUST OIL PRESSURE REF. 71-00-00
NO CHANGE
CONTACT P&WC CUSTOMER SUPPORT FOR DISPOSITION

C32162C

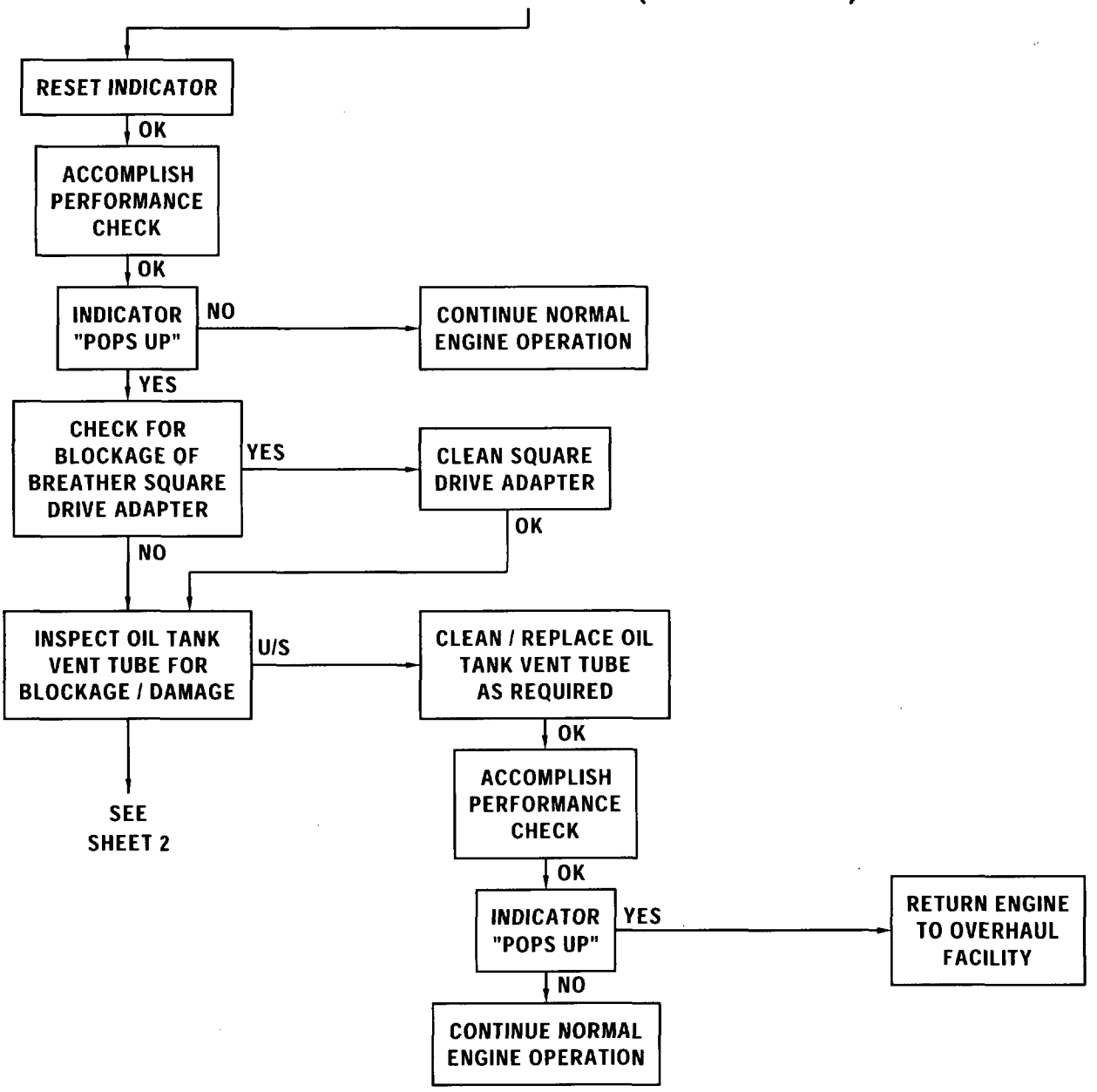
Lubrication Problems - High Oil Pressure
Figure 132



C32161A

Lubrication Problems - Black/Discolored Oil
Figure 133

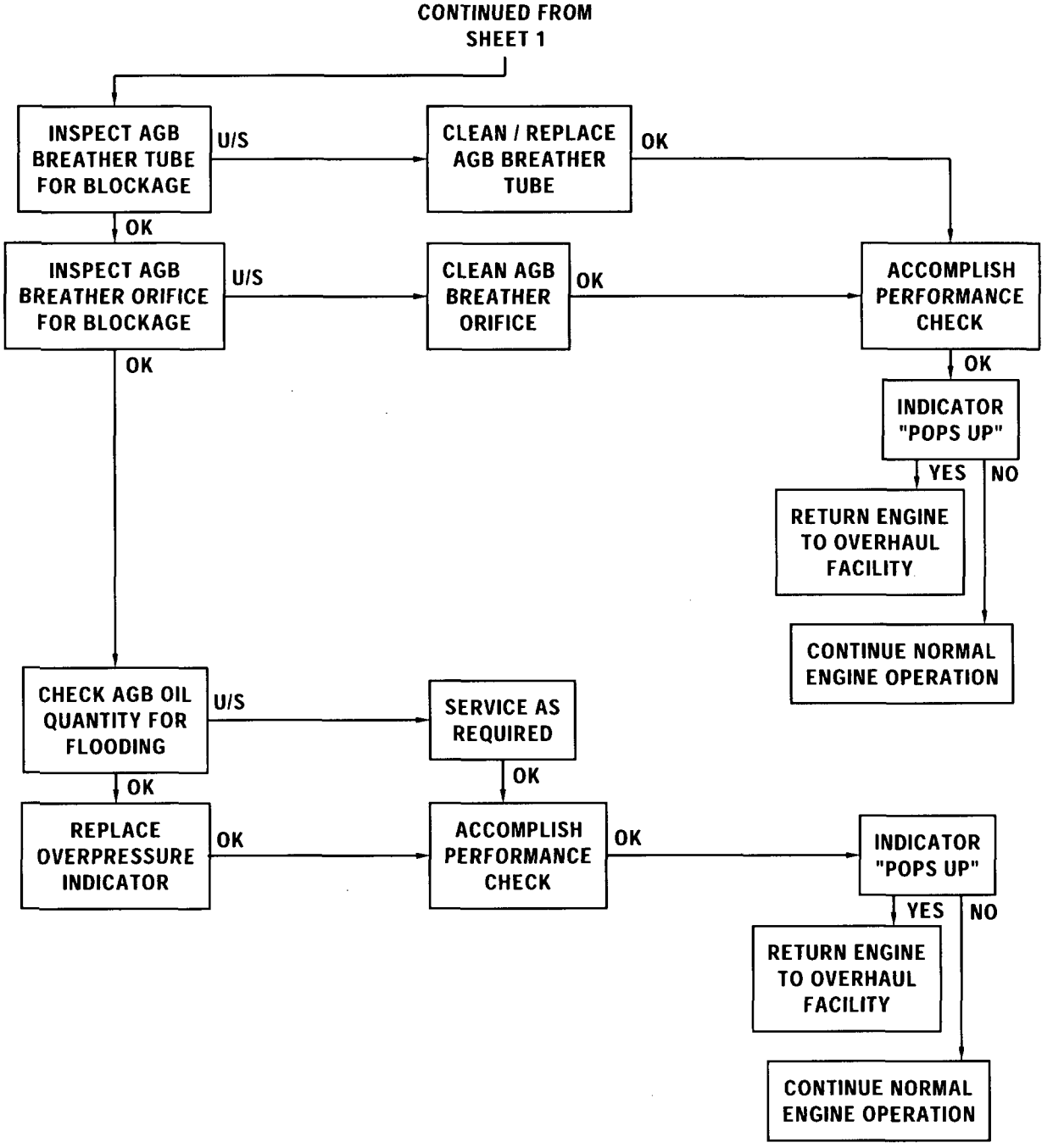
OVERPRESSURE INDICATOR (POST-SB24021) "POPS UP"



C32636C

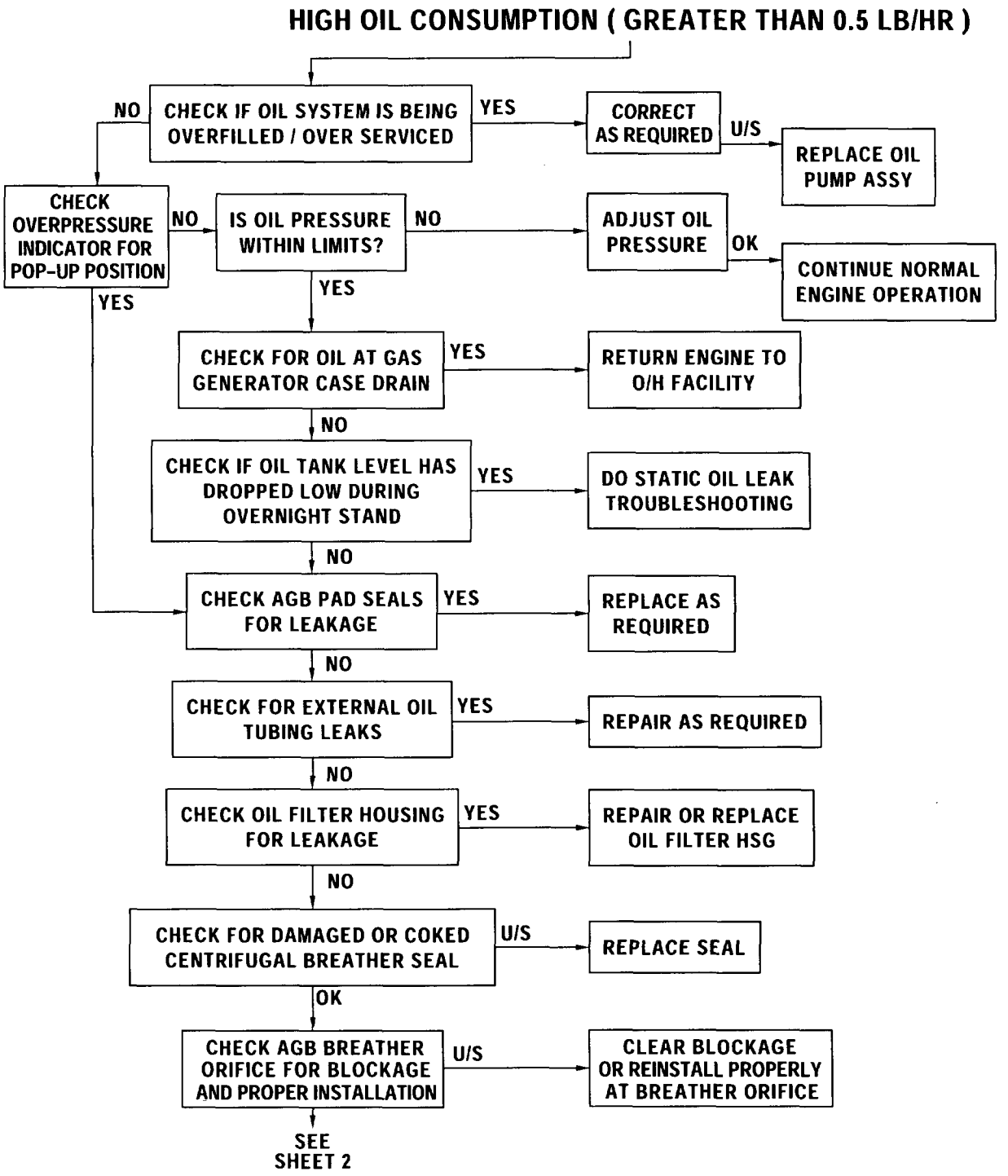
Lubrication Problems - Over-pressure Indicator "Pops Up"
Figure 134 (Sheet 1 of 2)

OVERPRESSURE INDICATOR (POST-SB24021) "POPS UP"

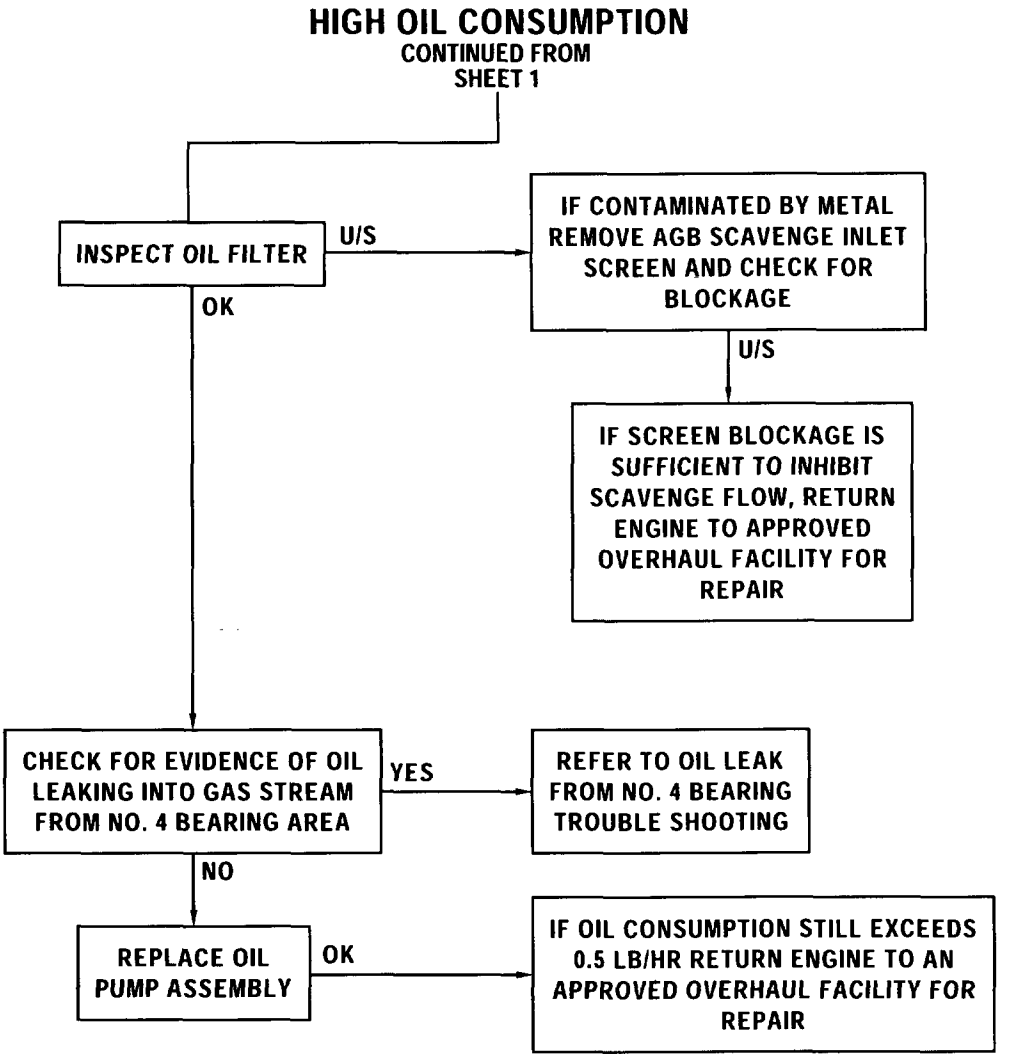


C33919

Lubrication Problems - Over-pressure Indicator "Pops Up"
Figure 134 (Sheet 2)

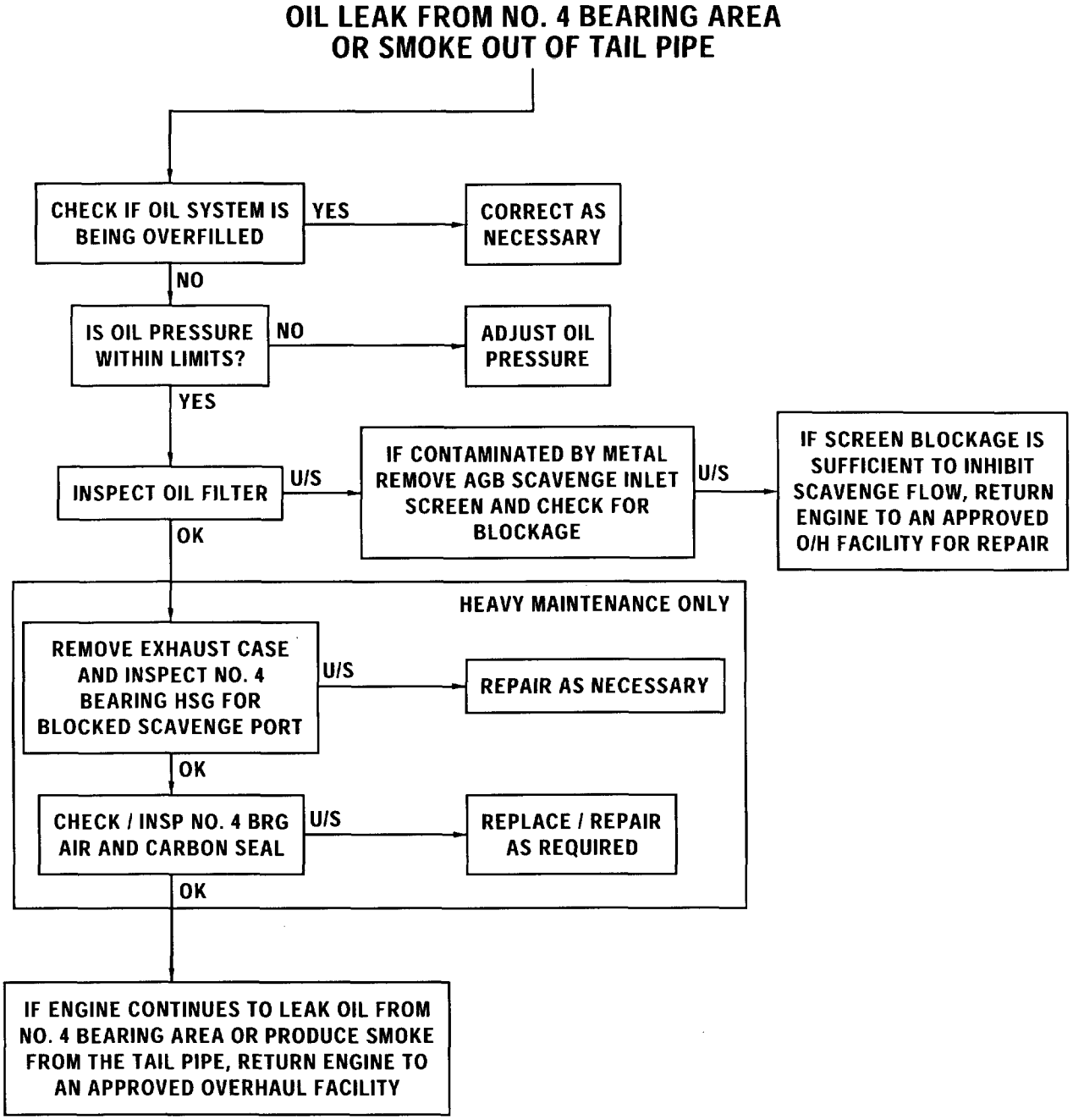


Lubrication Problems - High Oil Consumption
Figure 135 (Sheet 1 of 2)


HIGH OIL CONSUMPTION
CONTINUED FROM
SHEET 1
INSPECT OIL FILTER
U/S
IF CONTAMINATED BY METAL REMOVE AGB SCAVENGE INLET SCREEN AND CHECK FOR BLOCKAGE
OK
U/S
IF SCREEN BLOCKAGE IS SUFFICIENT TO INHIBIT SCAVENGE FLOW, RETURN ENGINE TO APPROVED OVERHAUL FACILITY FOR REPAIR
CHECK FOR EVIDENCE OF OIL LEAKING INTO GAS STREAM FROM NO. 4 BEARING AREA
YES
REFER TO OIL LEAK FROM NO. 4 BEARING TROUBLE SHOOTING
NO
REPLACE OIL PUMP ASSEMBLY
OK
IF OIL CONSUMPTION STILL EXCEEDS 0.5 LB/HR RETURN ENGINE TO AN APPROVED OVERHAUL FACILITY FOR REPAIR

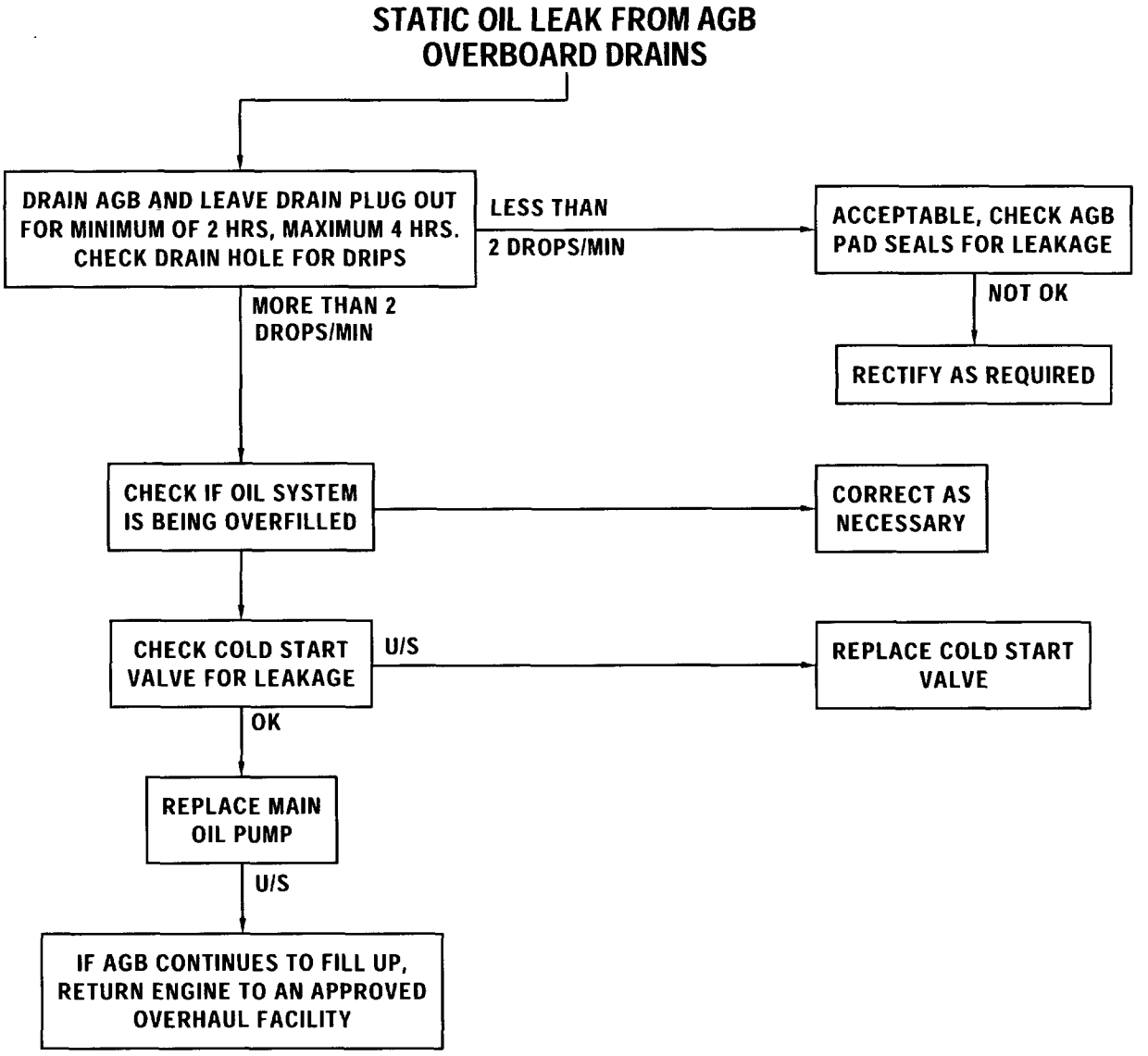
C33908

Lubrication Problems - High Oil Consumption
Figure 135 (Sheet 2)


OIL LEAK FROM NO. 4 BEARING AREA OR SMOKE OUT OF TAIL PIPE
CHECK IF OIL SYSTEM IS BEING OVERFILLED
YES
CORRECT AS NECESSARY
NO
IS OIL PRESSURE WITHIN LIMITS?
NO
ADJUST OIL PRESSURE
YES
INSPECT OIL FILTER
U/S
IF CONTAMINATED BY METAL REMOVE AGB SCAVENGE INLET SCREEN AND CHECK FOR BLOCKAGE
U/S
IF SCREEN BLOCKAGE IS SUFFICIENT TO INHIBIT SCAVENGE FLOW, RETURN ENGINE TO AN APPROVED O/H FACILITY FOR REPAIR
OK
HEAVY MAINTENANCE ONLY
REMOVE EXHAUST CASE AND INSPECT NO. 4 BEARING HSG FOR BLOCKED SCAVENGE PORT
U/S
REPAIR AS NECESSARY
OK
CHECK / INSP NO. 4 BRG AIR AND CARBON SEAL
U/S
REPLACE / REPAIR AS REQUIRED
OK
IF ENGINE CONTINUES TO LEAK OIL FROM NO. 4 BEARING AREA OR PRODUCE SMOKE FROM THE TAIL PIPE, RETURN ENGINE TO AN APPROVED OVERHAUL FACILITY

C33909

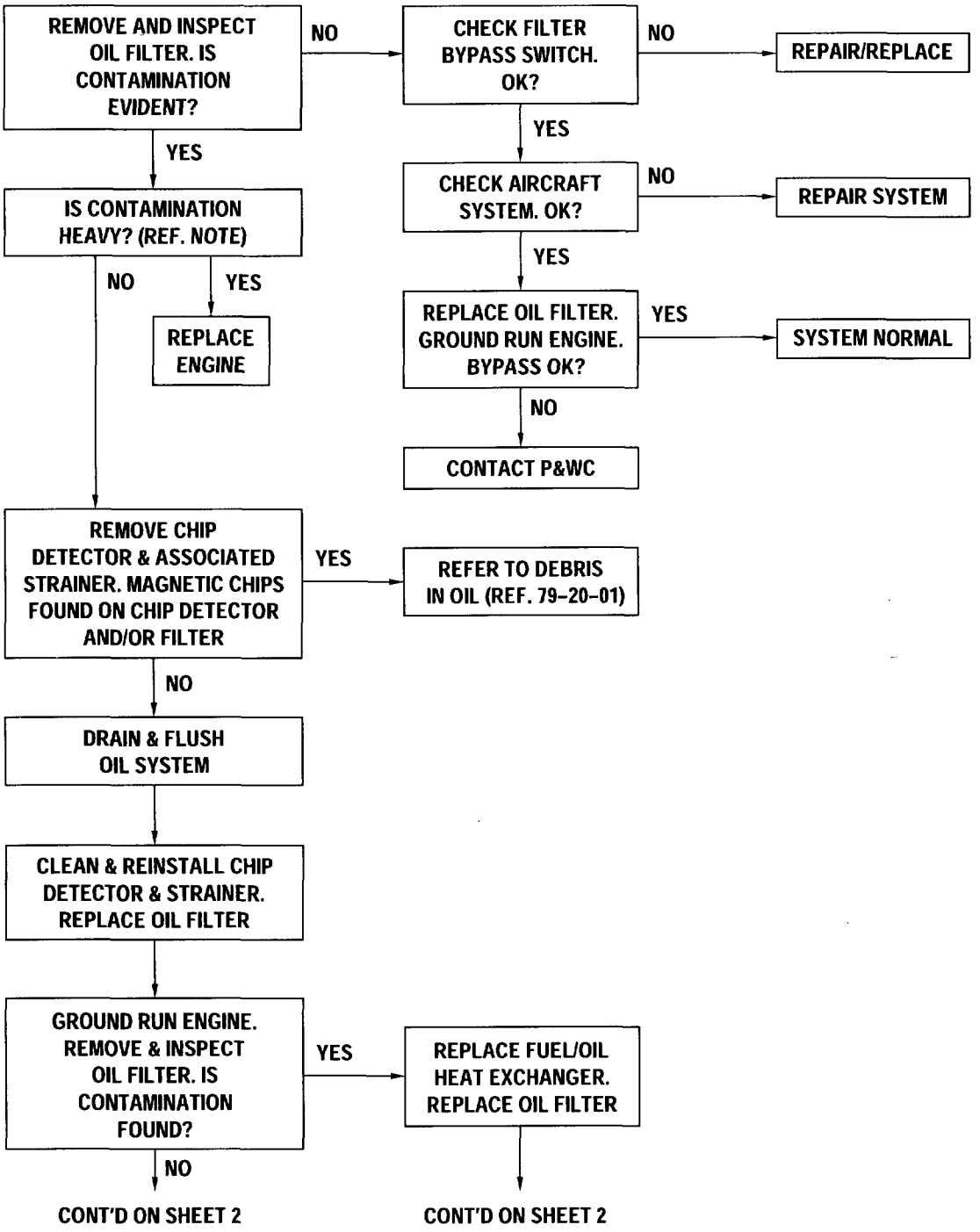
Lubrication Problems - Oil Leak from No. 4 Bearing Area or Smoke Out of Tail Pipe
Figure 136


STATIC OIL LEAK FROM AGB OVERBOARD DRAINS
DRAIN AGB AND LEAVE DRAIN PLUG OUT FOR MINIMUM OF 2 HRS, MAXIMUM 4 HRS. CHECK DRAIN HOLE FOR DRIPS
LESS THAN 2 DROPS/MIN
ACCEPTABLE, CHECK AGB PAD SEALS FOR LEAKAGE
NOT OK
RECTIFY AS REQUIRED
MORE THAN 2 DROPS/MIN
CHECK IF OIL SYSTEM IS BEING OVERFILLED
CORRECT AS NECESSARY
CHECK COLD START VALVE FOR LEAKAGE
U/S
REPLACE COLD START VALVE
OK
REPLACE MAIN OIL PUMP
U/S
IF AGB CONTINUES TO FILL UP, RETURN ENGINE TO AN APPROVED OVERHAUL FACILITY

C33925

Lubrication Problems - Static Oil Leak from AGB Overboard Drains
Figure 137

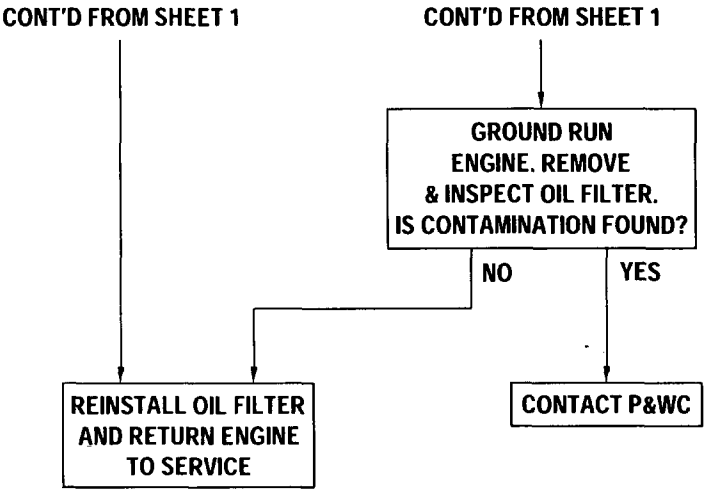
OIL FILTER BYPASS INDICATION



C74762

Lubrication Problems - Oil Filter Bypass Indication
Figure 138 (Sheet 1 of 2)

OIL FILTER BYPASS INDICATION

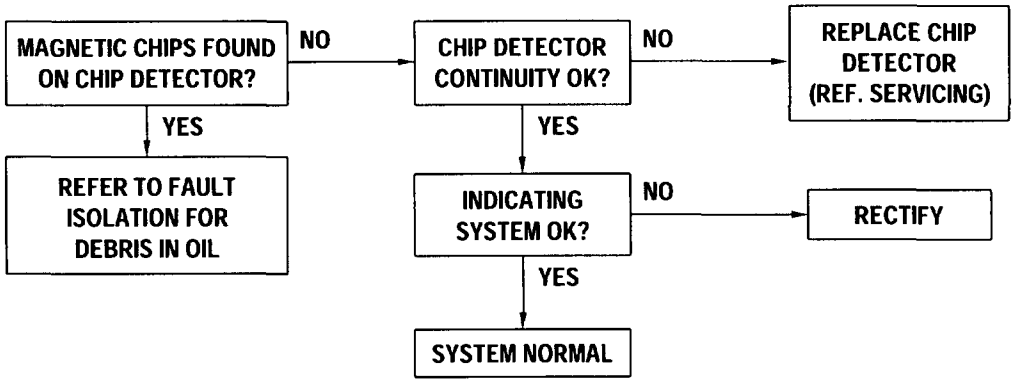

CONT'D FROM SHEET 1
CONT'D FROM SHEET 1
GROUND RUN ENGINE. REMOVE & INSPECT OIL FILTER. IS CONTAMINATION FOUND?
NO
YES
REINSTALL OIL FILTER AND RETURN ENGINE TO SERVICE
CONTACT P&WC

NOTE: A BYPASS INDICATION DOES NOT NECESSARILY MEAN THAT THE OIL FILTER WAS BYPASSED. AN ASSESSMENT OF THE AMOUNT OF CONTAMINATION CAN INDICATE WHETHER A BYPASS HAS ACTUALLY OCCURRED. IF DEBRIS IS DEPOSITED ON MOST OF FILTER ELEMENT SURFACE AND ASSOCIATED HOUSING, IT CAN BE CONCLUDED THAT A BYPASS HAS OCCURRED. IN THIS SITUATION, IT IS RECOMMENDED THAT THE ENGINE BE REMOVED AS THE DEBRIS COULD HAVE PLUGGED OIL NOZZLE JETS AND REDUCED BEARINGS AND/OR GEARS LUBRICATION.

C74763

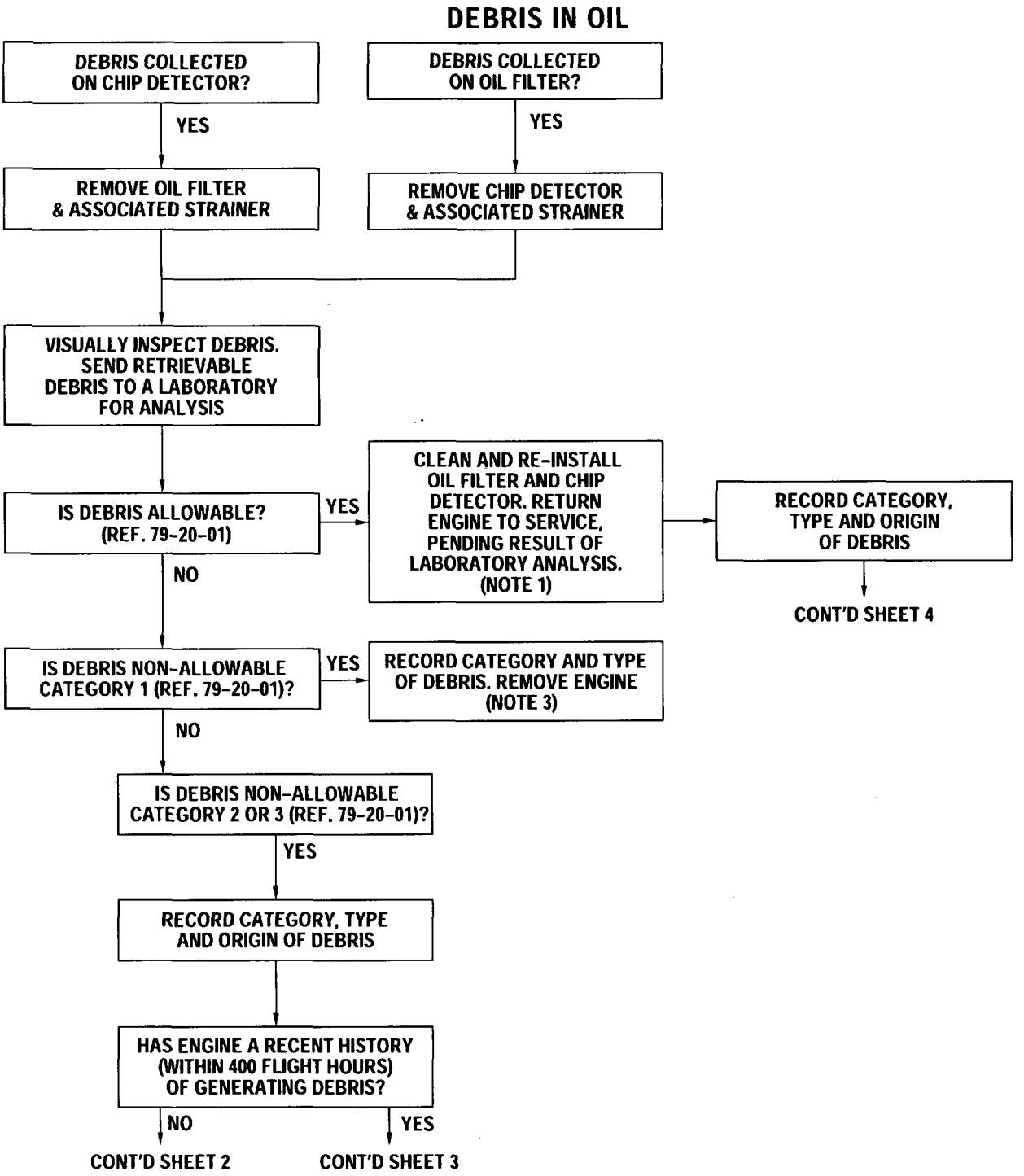
Lubrication Problems - Oil Filter Bypass Indication
Figure 138 (Sheet 2)

CHIP DETECTOR INDICATION



C74719

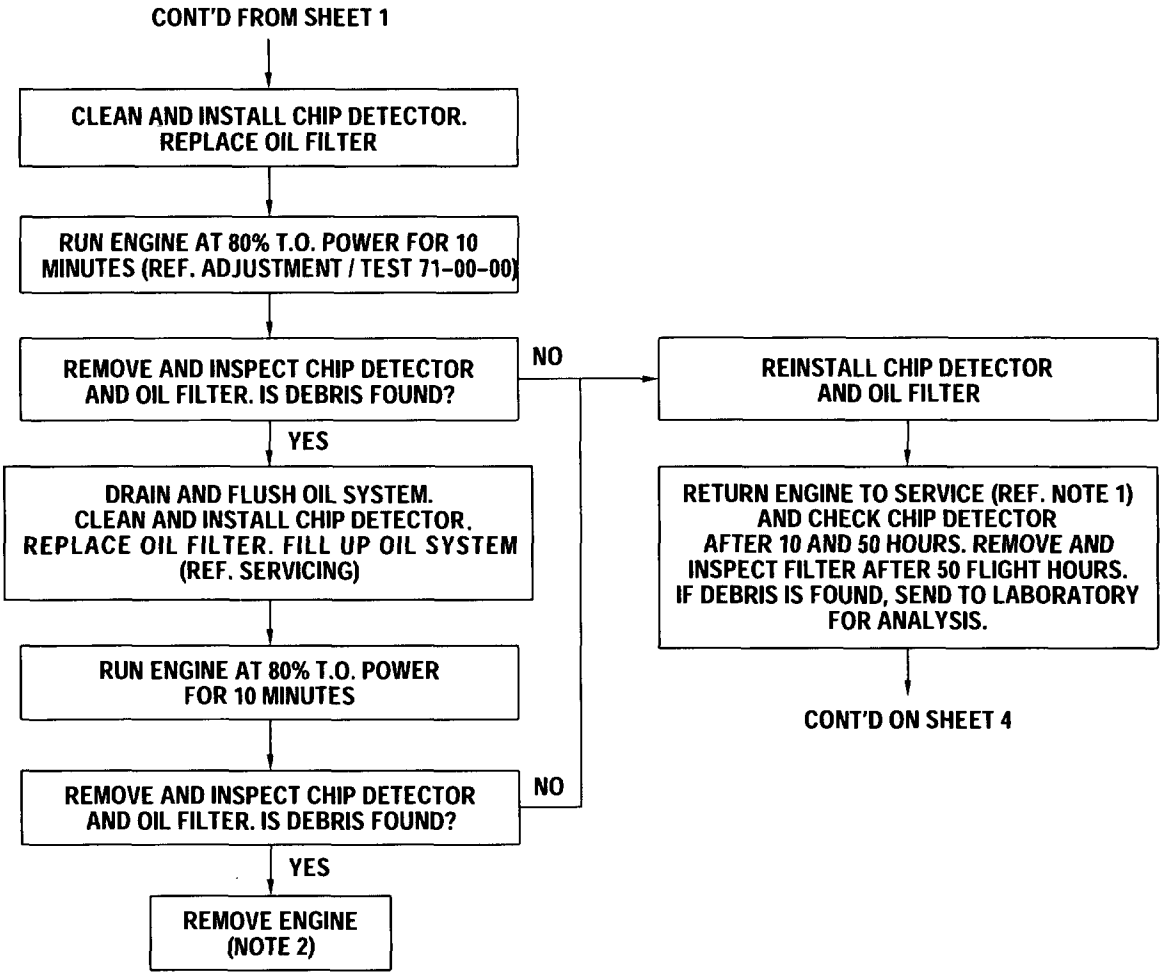
Lubrication Problems - Chip Detector Indication
Figure 139


DEBRIS IN OIL
DEBRIS COLLECTED ON CHIP DETECTOR?
YES
REMOVE OIL FILTER & ASSOCIATED STRAINER
DEBRIS COLLECTED ON OIL FILTER?
YES
REMOVE CHIP DETECTOR & ASSOCIATED STRAINER
VISUALLY INSPECT DEBRIS. SEND RETRIEVABLE DEBRIS TO A LABORATORY FOR ANALYSIS
IS DEBRIS ALLOWABLE? (REF. 79-20-01)
YES
CLEAN AND RE-INSTALL OIL FILTER AND CHIP DETECTOR. RETURN ENGINE TO SERVICE, PENDING RESULT OF LABORATORY ANALYSIS. (NOTE 1)
RECORD CATEGORY, TYPE AND ORIGIN OF DEBRIS
CONT'D SHEET 4
NO
IS DEBRIS NON-ALLOWABLE CATEGORY 1 (REF. 79-20-01)?
YES
RECORD CATEGORY AND TYPE OF DEBRIS. REMOVE ENGINE (NOTE 3)
NO
IS DEBRIS NON-ALLOWABLE CATEGORY 2 OR 3 (REF. 79-20-01)?
YES
RECORD CATEGORY, TYPE AND ORIGIN OF DEBRIS
HAS ENGINE A RECENT HISTORY (WITHIN 400 FLIGHT HOURS) OF GENERATING DEBRIS?
NO
CONT'D SHEET 2
YES
CONT'D SHEET 3

C74678

Lubrication Problems - Debris in Oil
Figure 140 (Sheet 1 of 4)

DEBRIS IN OIL


CONT'D FROM SHEET 1
CLEAN AND INSTALL CHIP DETECTOR. REPLACE OIL FILTER
RUN ENGINE AT 80% T.O. POWER FOR 10 MINUTES (REF. ADJUSTMENT / TEST 71-00-00)
REMOVE AND INSPECT CHIP DETECTOR AND OIL FILTER. IS DEBRIS FOUND?
NO
REINSTALL CHIP DETECTOR AND OIL FILTER
YES
DRAIN AND FLUSH OIL SYSTEM. CLEAN AND INSTALL CHIP DETECTOR. REPLACE OIL FILTER. FILL UP OIL SYSTEM (REF. SERVICING)
RETURN ENGINE TO SERVICE (REF. NOTE 1) AND CHECK CHIP DETECTOR AFTER 10 AND 50 HOURS. REMOVE AND INSPECT FILTER AFTER 50 FLIGHT HOURS. IF DEBRIS IS FOUND, SEND TO LABORATORY FOR ANALYSIS.
CONT'D ON SHEET 4
RUN ENGINE AT 80% T.O. POWER FOR 10 MINUTES
REMOVE AND INSPECT CHIP DETECTOR AND OIL FILTER. IS DEBRIS FOUND?
NO
YES
REMOVE ENGINE (NOTE 2)

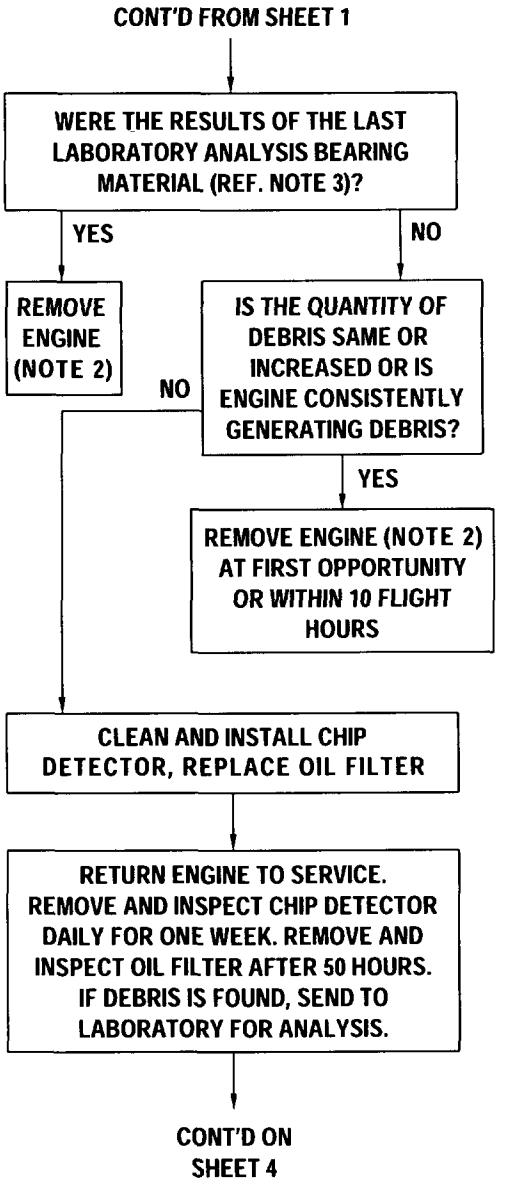
NOTE:

1. RESULTS OF PREVIOUS LABORATORY ANALYSIS AND ORIGIN OF DEBRIS SHOULD BE DETERMINED WITHIN 50 FLIGHT HOURS OF ORIGINAL DETECTION OF DEBRIS.
2. IF DEBRIS IS GENERATED BY ACCESSORY GEARBOX, THIS MAY BE REPLACED INSTEAD OF THE ENGINE.
3. RESULTS OF LAST ANALYSIS MUST BE KNOWN PRIOR TO CONTINUING.

C74681

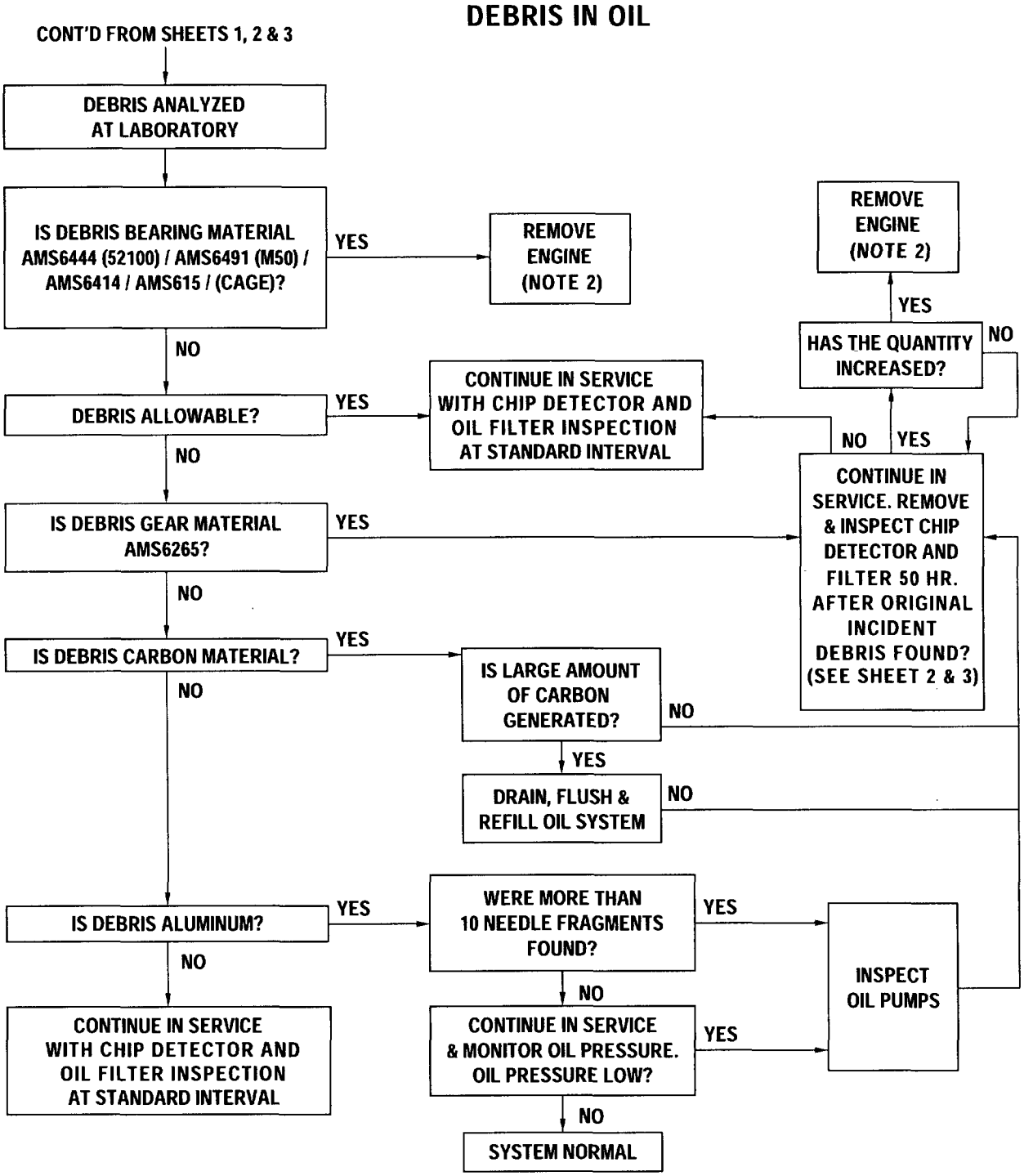
Lubrication Problems - Debris in Oil
Figure 140 (Sheet 2)

DEBRIS IN OIL


CONT'D FROM SHEET 1
WERE THE RESULTS OF THE LAST LABORATORY ANALYSIS BEARING MATERIAL (REF. NOTE 3)?
YES
NO
REMOVE ENGINE (NOTE 2)
IS THE QUANTITY OF DEBRIS SAME OR INCREASED OR IS ENGINE CONSISTENTLY GENERATING DEBRIS?
NO
YES
REMOVE ENGINE (NOTE 2) AT FIRST OPPORTUNITY OR WITHIN 10 FLIGHT HOURS
CLEAN AND INSTALL CHIP DETECTOR, REPLACE OIL FILTER
RETURN ENGINE TO SERVICE. REMOVE AND INSPECT CHIP DETECTOR DAILY FOR ONE WEEK. REMOVE AND INSPECT OIL FILTER AFTER 50 HOURS. IF DEBRIS IS FOUND, SEND TO LABORATORY FOR ANALYSIS.
CONT'D ON SHEET 4

C74682

Lubrication Problems - Debris in Oil
Figure 140 (Sheet 3)



Lubrication Problems - Debris in Oil
Figure 140 (Sheet 4)

FAULT ISOLATION - 2

1. MFD Codes 1A to 5M

   A. List of Figures

      (1) Refer to FAULT ISOLATION - 1 for locations of connectors and LRUs.

      (2) Table 101 lists all figures contained in Fault Isolation - 2.

TABLE 101, List of Figures

Figure Title	Figure No.
MFD Codes with LRU Prefix 1	101
MFD Codes with LRU Prefix 2	102
MFD Codes with LRU Prefix 3	103
MFD Codes with LRU Prefix 4	104
MFD Codes with LRU Prefix 5	105

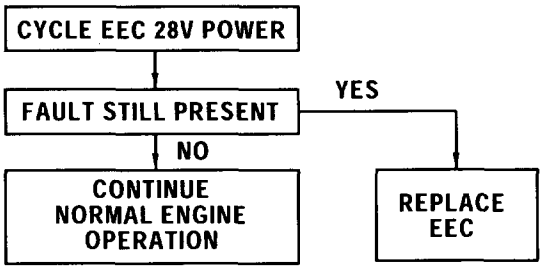
P&WC Proprietary Information. Subject to the restrictions on the title page.

MFD CODE	FAULT	FAULT LEVEL
1A	SOFTWARE FAIL	3
1B	PROCESSOR FAIL	3
1C	ROM FAIL	3
1D	RAM FAIL	3
1E	SPURIOUS INTERRUPT	3
1F	WATCHDOG FAILED TO RESET PROCESSOR	3
1G	SOFTWARE NOT EXECUTING REGULARLY	3
1H	TASK OVER-RUN	3
1J	PARITY CHECK	3

EFFECTS ON SYSTEM – 1A,1B,1C,1D,1E,1F,1G,1H,1J
- Ⓢ EEC CHANNEL SWITCHOVER

– 1H, 1J
- EEC LOSS OF CONTROL
- POSSIBLE ENGINE SHUTDOWN

CORRECTIVE ACTION



NOTE: Ⓢ = SINGLE CHANNEL FAULT

Pre-SB24434/Post-SB24514 C31451B

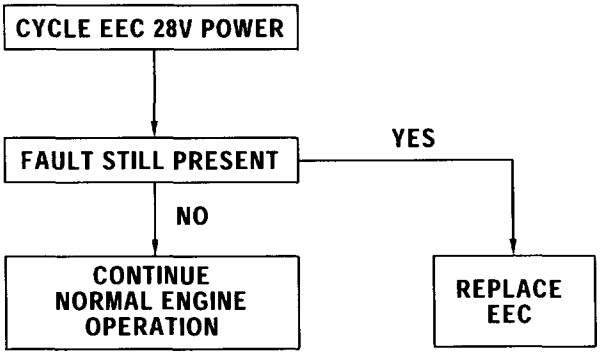
MFD Codes with LRU Prefix 1
Figure 101

MFD CODE	FAULT	FAULT LEVEL
2A	WATCHDOG CAUSED PROCESSOR RESET	3

EFFECTS ON SYSTEM -

- Ⓓ EEC LOSS OF CONTROL
- Ⓢ EEC CHANNEL SWITCHOVER
- Ⓓ POSSIBLE ENGINE SHUTDOWN
- Ⓢ EEC PROCESSOR RESET

CORRECTIVE ACTION



NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

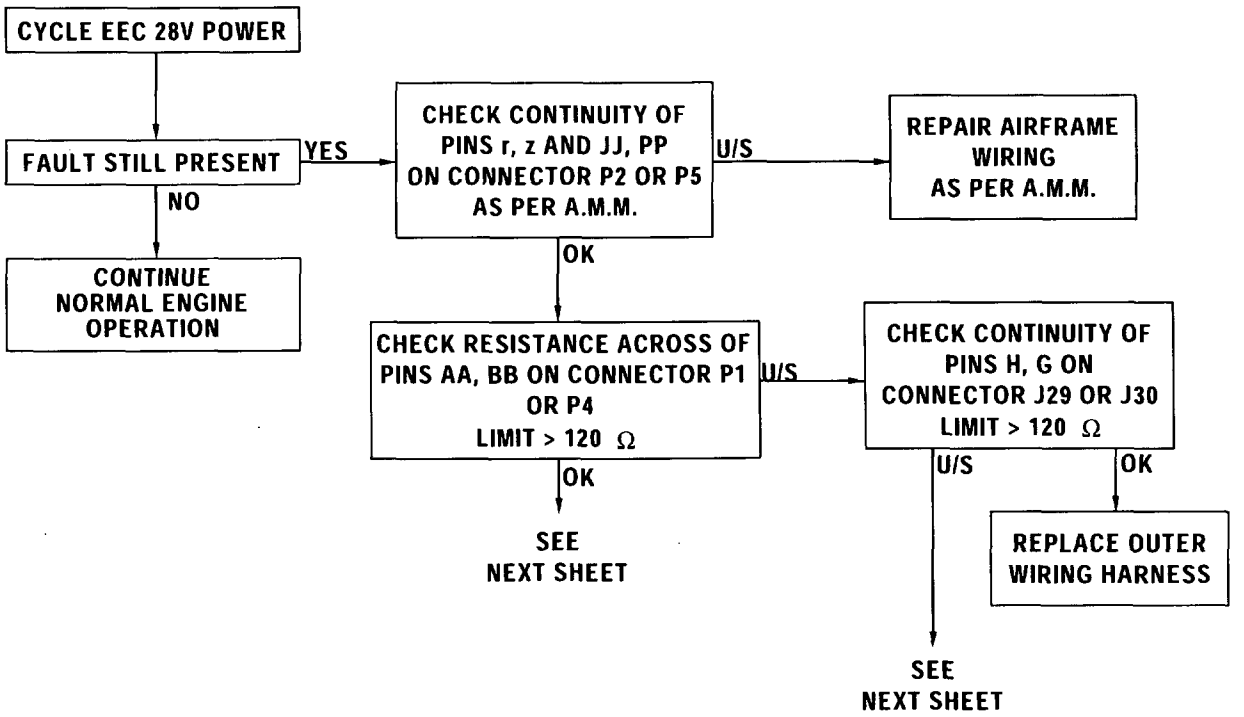
Pre-SB24434/Post-SB24514 C31028C

MFD Codes with LRU Prefix 2
Figure 102 (Sheet 1 of 10)

MFD CODE	FAULT	FAULT LEVEL
2D	BITE CIRCUIT	2

EFFECTS ON SYSTEM - Ⓓ EEC OUTPUT DRIVER(S) MALFUNCTION
- Ⓓ LOSS OF ONE OR MORE OF:
  - I) IGNITER CONTROL
  - II) BOV CONTROL
  - III) FAULT LAMP INDICATION
  - IV) APR LAMP INDICATION
  - V) FUEL START VALVE CONTROL
- Ⓢ EEC CHANNEL SWITCHOVER

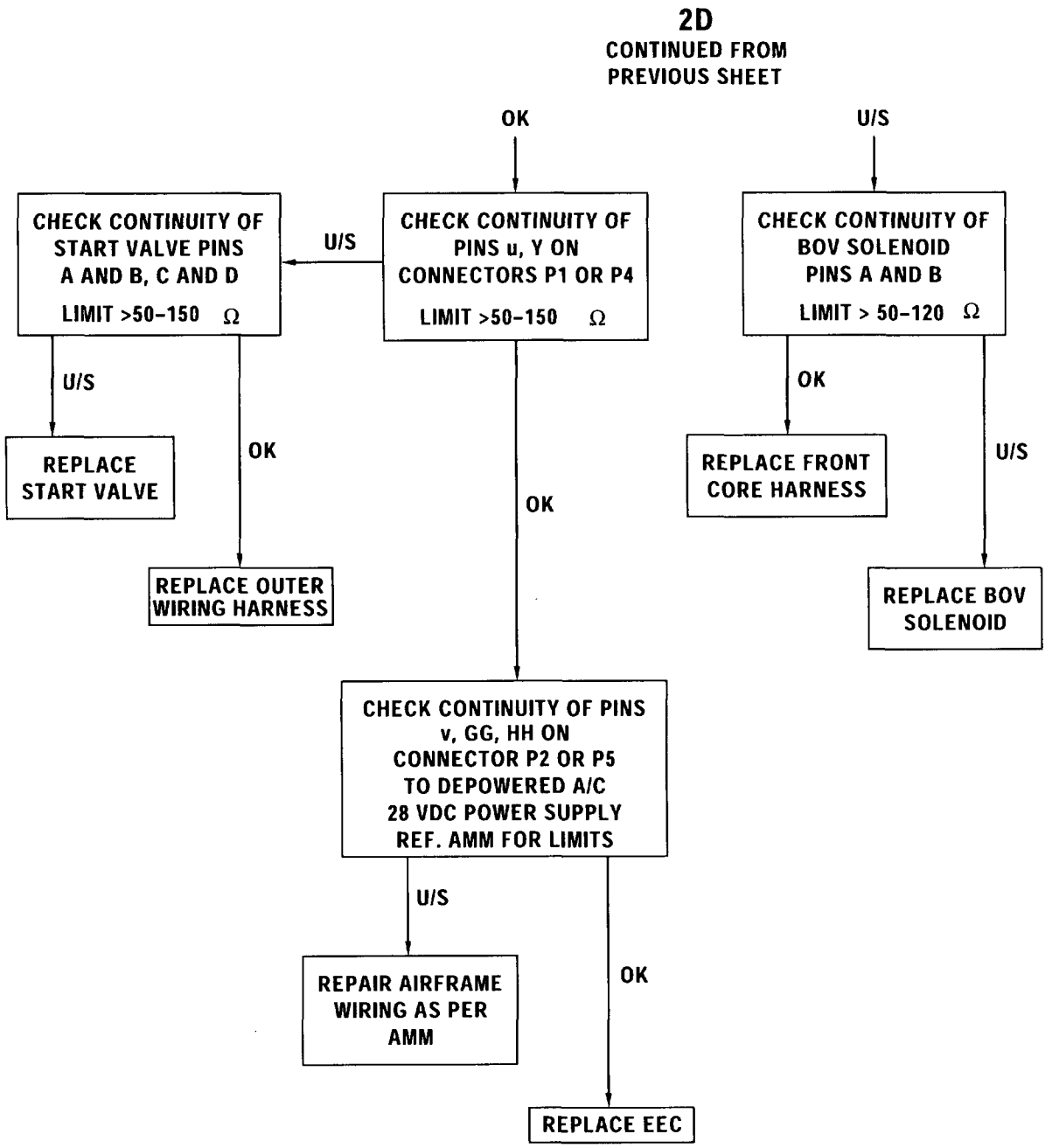
CORRECTIVE ACTION - IF BITE CIRCUIT FAULT OCCURS IN CONJUNCTION WITH OTHER EEC FAULTS, FOLLOW CORRECTIVE ACTION RELEVANT TO THOSE FAULTS.
IF BITE CIRCUIT FAULT OCCURS AS A SINGLE FAULT, RECYCLE.


CYCLE EEC 28V POWER
FAULT STILL PRESENT
YES
NO
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY OF PINS r, z AND JJ, PP ON CONNECTOR P2 OR P5 AS PER A.M.M.
U/S
REPAIR AIRFRAME WIRING AS PER A.M.M.
OK
CHECK RESISTANCE ACROSS OF PINS AA, BB ON CONNECTOR P1 OR P4 LIMIT > 120 Ω
U/S
OK
SEE NEXT SHEET
CHECK CONTINUITY OF PINS H, G ON CONNECTOR J29 OR J30 LIMIT > 120 Ω
U/S
OK
REPLACE OUTER WIRING HARNESS
SEE NEXT SHEET

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C33724A

MFD Codes with LRU Prefix 2
Figure 102 (Sheet 2)



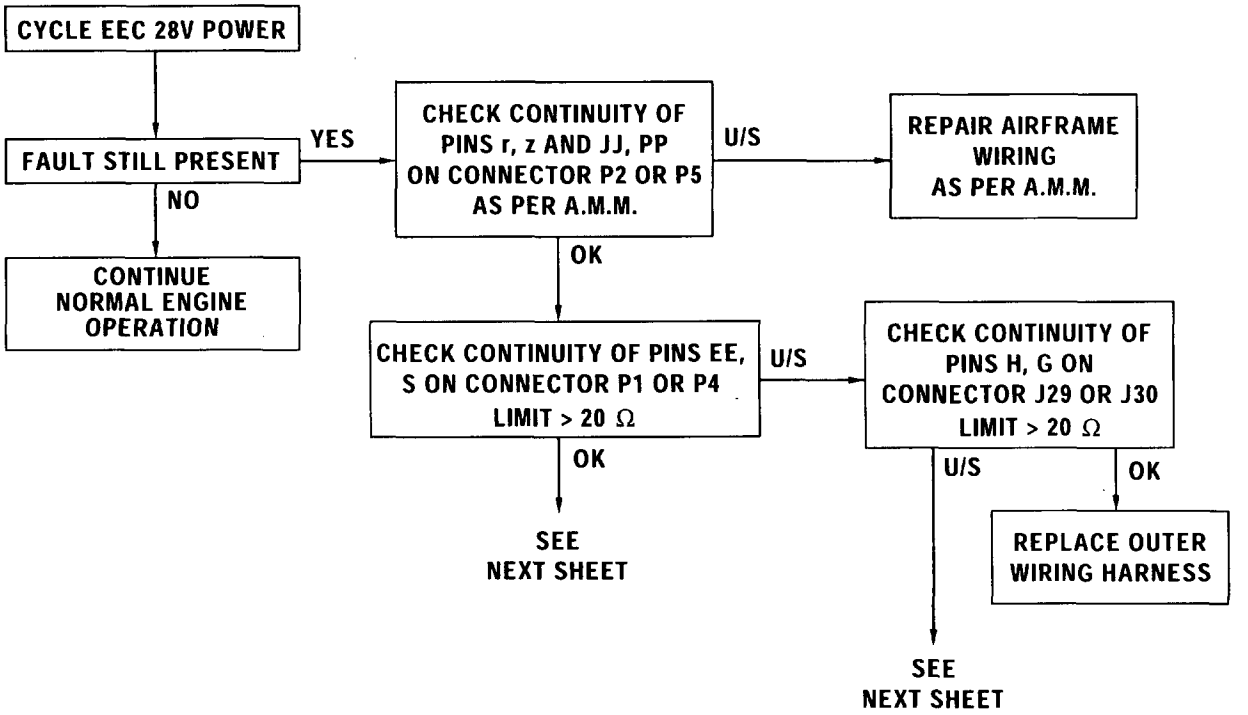
Pre-SB24434/Post-SB24514 C33725A

MFD Codes with LRU Prefix 2
Figure 102 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
2D	BITE CIRCUIT	2

EFFECTS ON SYSTEM - Ⓓ EEC OUTPUT DRIVER(S) MALFUNCTION
- Ⓓ LOSS OF ONE OR MORE OF:
  - I) IGNITER CONTROL
  - II) BOV CONTROL
  - III) FAULT LAMP INDICATION
  - IV) APR LAMP INDICATION
- Ⓢ EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION - IF BITE CIRCUIT FAULT OCCURS IN CONJUNCTION WITH OTHER EEC FAULTS, FOLLOW CORRECTIVE ACTION RELEVANT TO THOSE FAULTS.
IF BITE CIRCUIT FAULT OCCURS AS A SINGLE FAULT, RECYCLE.

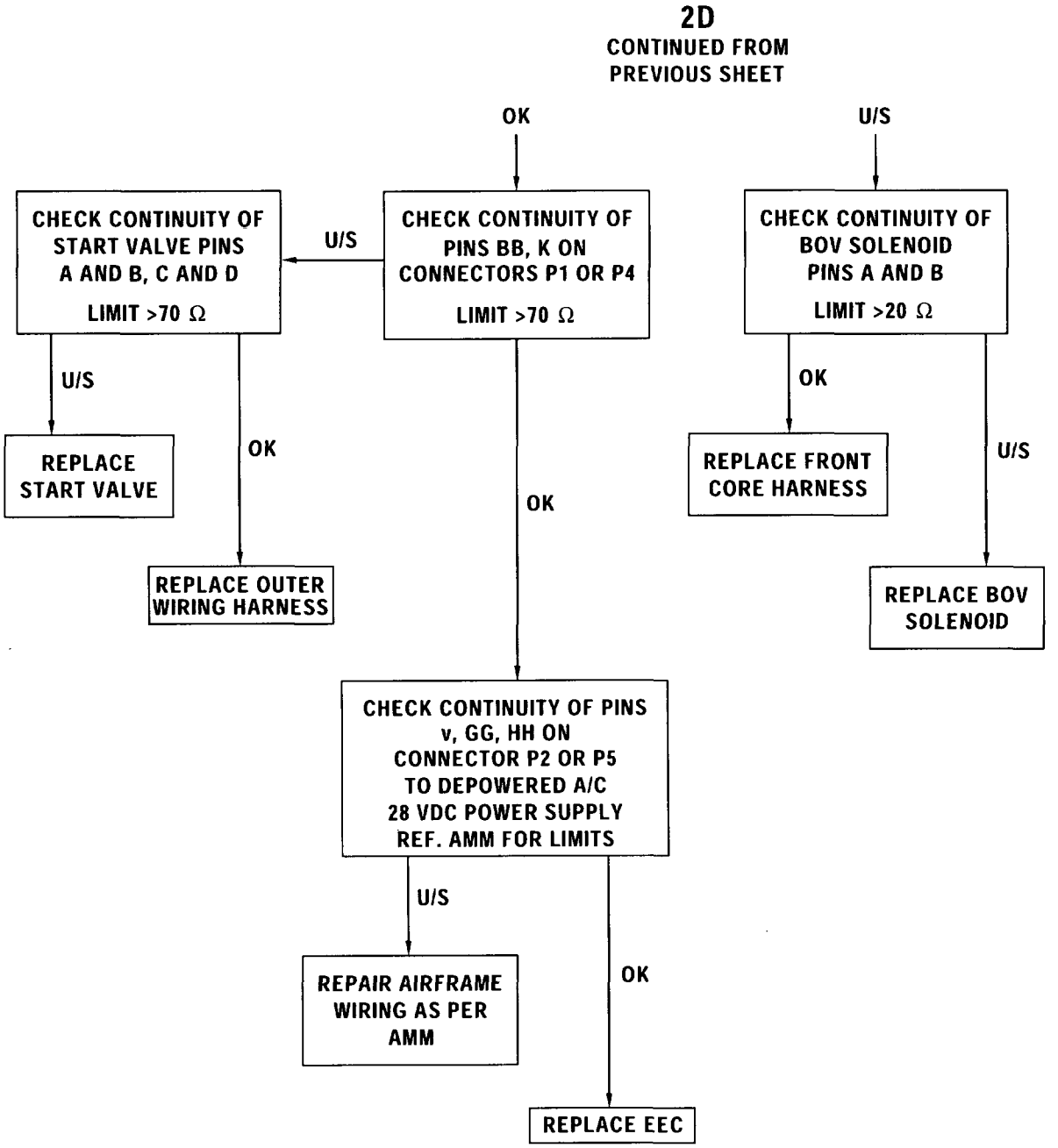

CYCLE EEC 28V POWER
FAULT STILL PRESENT
YES
NO
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY OF PINS r, z AND JJ, PP ON CONNECTOR P2 OR P5 AS PER A.M.M.
U/S
REPAIR AIRFRAME WIRING AS PER A.M.M.
OK
CHECK CONTINUITY OF PINS EE, S ON CONNECTOR P1 OR P4 LIMIT > 20 Ω
U/S
CHECK CONTINUITY OF PINS H, G ON CONNECTOR J29 OR J30 LIMIT > 20 Ω
OK
SEE NEXT SHEET
U/S
OK
REPLACE OUTER WIRING HARNESS
SEE NEXT SHEET

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C62154

MFD Codes with LRU Prefix 2
Figure 102 (Sheet 4)

P&WC Proprietary Information. Subject to the restrictions on the title page.



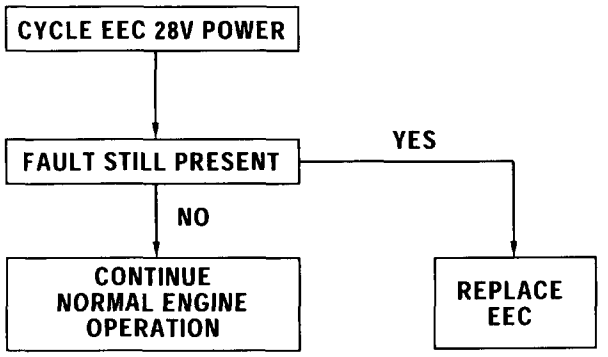
Post-SB24434/Pre-SB24514 C62155

MFD Codes with LRU Prefix 2
Figure 102 (Sheet 5)

MFD CODE	FAULT	FAULT LEVEL
2E	A/D FAULT	3

EFFECTS ON SYSTEM – – Ⓓ EEC LOSS OF CONTROL
– Ⓢ EEC CHANNEL SWITCHOVER
– Ⓓ POSSIBLE ENGINE SHUTDOWN

CORRECTIVE ACTION



NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

C61056

MFD Codes with LRU Prefix 2
Figure 102 (Sheet 6)

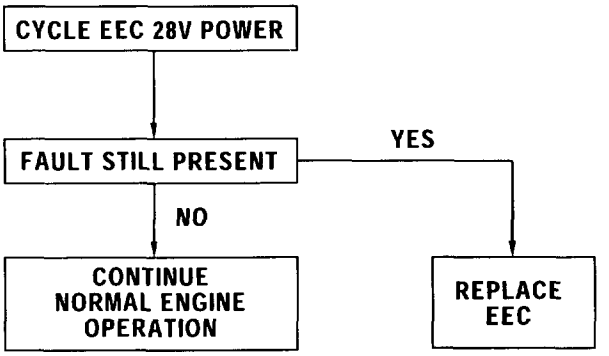
MFD CODES	FAULT	FAULT LEVEL
2F	T45 COLD JUNCTION	2
2G	OTHER LANE HEALTH OR CROSS COMMUNICATION FAULT	2
2H	EEROM FAIL	1

EFFECTS ON SYSTEM - 2F - Ⓓ INCORRECT T45 LIMIT CONTROL AND INDICATION
- Ⓓ POSSIBLE ABNORMAL ENGINE OPERATION :
I) ABNORMAL ENGINE STARTS
II) ABNORMAL ENGINE PERFORMANCE
III) ABNORMAL T45 LIMIT CONDITIONS

2G - Ⓢ POSSIBLE OTHER CHANNEL LOSS OF CONTROL
- Ⓢ EEC CHANNEL SWITCHOVER
- Ⓓ POSSIBLE DEGRADED ENGINE CONTROL

2H - POSSIBLE INVALID TRIM PLUG STATE
POSSIBLE EEC FAULT HISTORY LOST
- Ⓢ EEC CHANNEL SWITCHOVER
IF OTHER MFD CODES ARE PRESENT,
CHECK OTHER CODES FIRST.

CORRECTIVE ACTION



NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

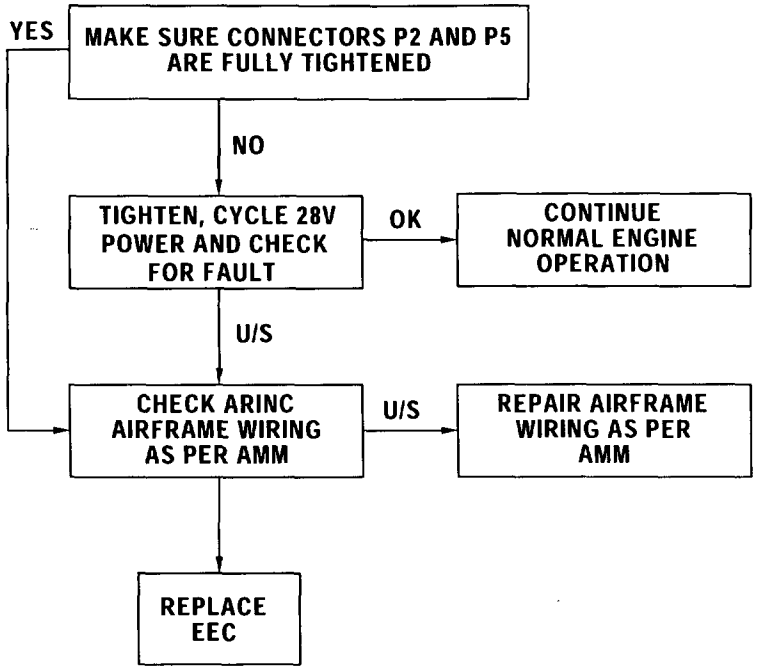
C31044C

MFD Codes with LRU Prefix 2
Figure 102 (Sheet 7)

MFD CODE	FAULT	FAULT LEVEL
2J	ARINC TRANSMIT	1

EFFECTS ON SYSTEM - Ⓢ LOSS OF ARINC AIRFRAME DATA FROM ONE CHANNEL OF EEC
- Ⓢ EEC LANE CHANGE
- Ⓓ LOSS OF ALL ARINC DATA FROM EEC TO AIRFRAME

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

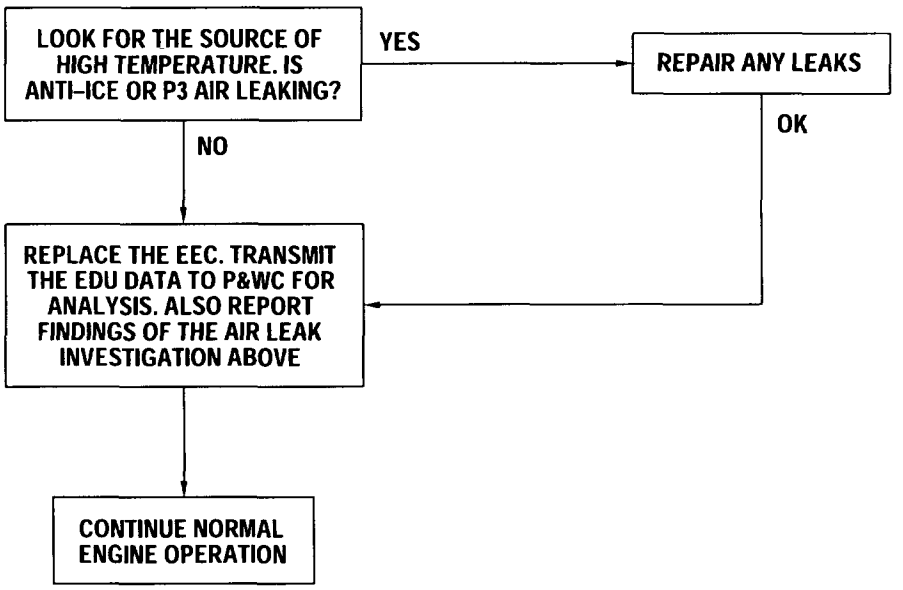
C31188C

MFD Codes with LRU Prefix 2
Figure 102 (Sheet 8)

FAULT CODE	FAULT	FAULT LEVEL
2K	EEC OVER-TEMPERATURE	3

EFFECTS ON SYSTEM - (S) (D) POSSIBLE DEGRADED EEC OPERATION

CORRECTIVE ACTION


LOOK FOR THE SOURCE OF HIGH TEMPERATURE. IS ANTI-ICE OR P3 AIR LEAKING?
YES
REPAIR ANY LEAKS
OK
NO
REPLACE THE EEC. TRANSMIT THE EDU DATA TO P&WC FOR ANALYSIS. ALSO REPORT FINDINGS OF THE AIR LEAK INVESTIGATION ABOVE
CONTINUE NORMAL ENGINE OPERATION

ADDITIONAL TROUBLE-SHOOTING TIPS:
IN REVIEWING THE EDU DATA, INTERROGATE THE COLD JUNCTION TEMPERATURE (PARAMETER NAME : CJC) OF THE EEC. IF THE CJC SHOWS A STEADY RISE TO 110 DEGREES CENTIGRADE WHEN THE 2K FAULT CODE IS LATCHED, THIS IS INDICATIVE THAT THE CAUSE WAS BAKING OF EEC FROM LEAKING ANTI - ICE OR P3 AIR. ON THE OTHER HAND, IF CJC IS ERRATICALLY RISING AND FALLING RAPIDLY, IT IS INDICATIVE OF AN ELECTRICAL FAILURE IN THE EEC COLD JUNCTION CIRCUIT, AND IS USUALLY ACCOMPANIED BY 2J AND FB FAULT CODES. IN EITHER CASE, THE EEC NEEDS TO BE REPLACED, BUT THE FORMER CASE NEEDS CORRECTION IN THE SOURCE OF HOT AIR LEAKS.

NOTE: (S) =SINGLE CHANNEL FAULT
(D) =DUAL CHANNEL FAULT

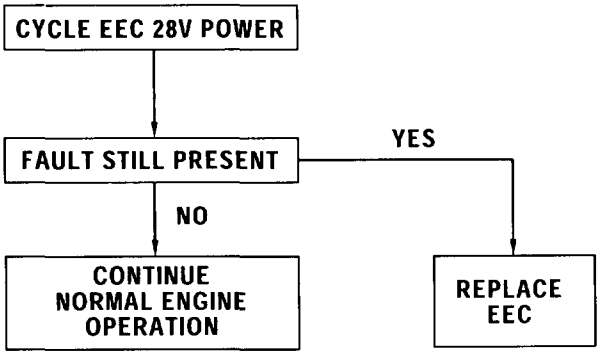
C88308B

MFD Codes with LRU Prefix 2
Figure 102 (Sheet 9)

MFD CODE	FAULT	FAULT LEVEL
2L	EEROM SOFTWARE TRIMS CHECKSUM FAIL	4

EFFECTS ON SYSTEM - Ⓢ EEC CHANNEL SWITCHOVER
- Ⓢ START ON ONE LANE OF EEC ONLY

CORRECTIVE ACTION



NOTE: Ⓢ= SINGLE CHANNEL FAULT

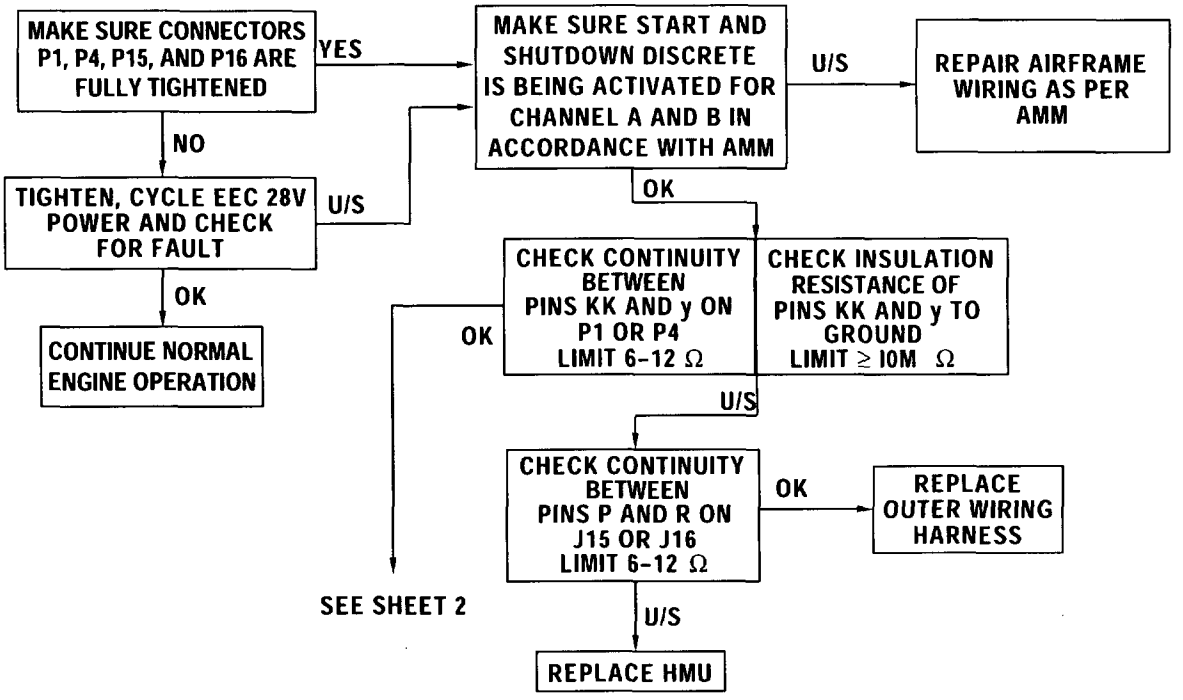
Pre-SB24434/Post-SB24514 C61866

MFD Codes with LRU Prefix 2
Figure 102 (Sheet 10)

MFD CODE	FAULT	FAULT LEVEL
3A	OVERSPEED DRIVE	3
3B	OVERSPEED START-UP	3

EFFECTS ON SYSTEM - 3A - POSSIBLE ENGINE LOSS OF OVERSPEED PROTECTION
3B - POSSIBLE ENGINE SHUTDOWN AT 40% TO 46% N2 DURING ENGINE START

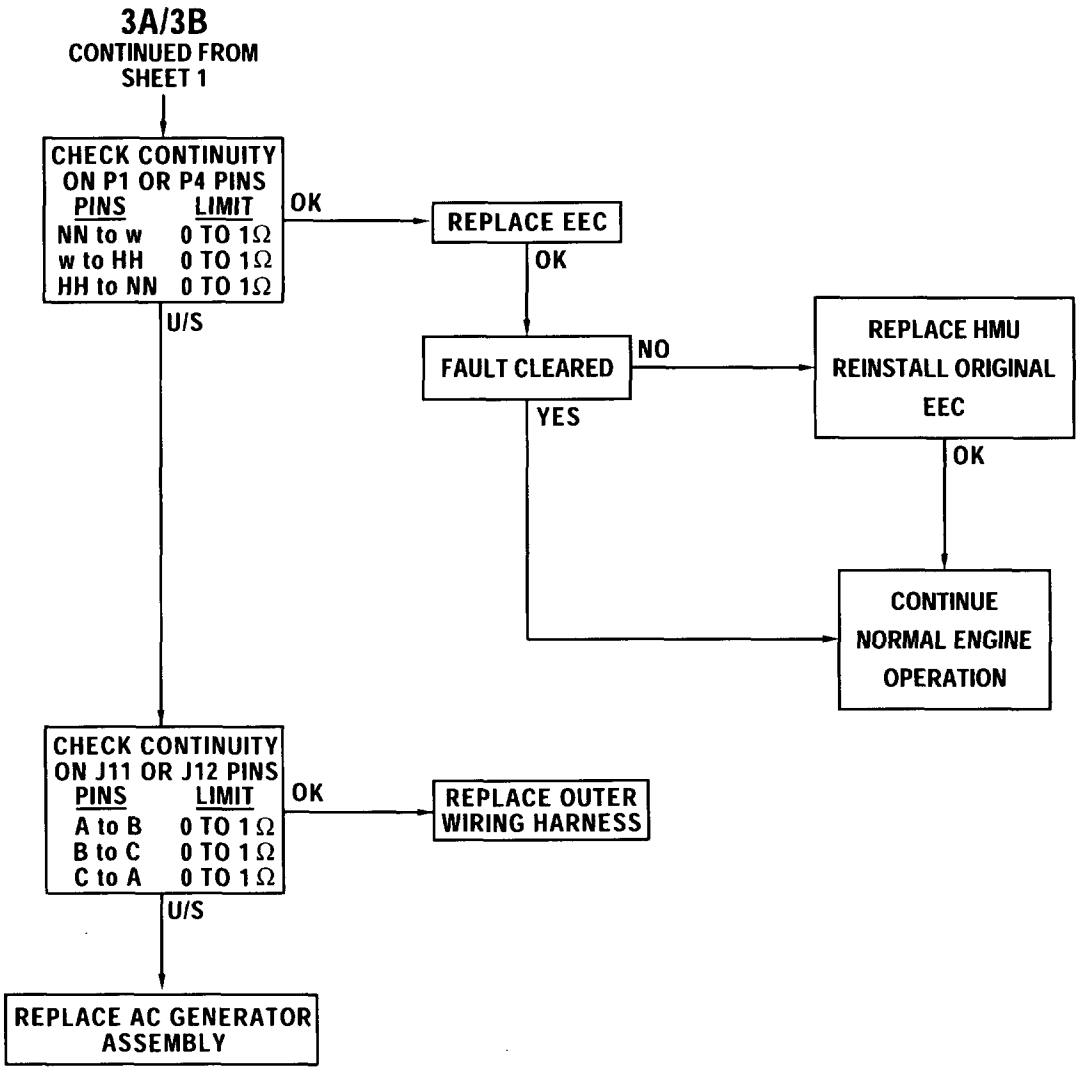
CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P15, AND P16 ARE FULLY TIGHTENED
YES
NO
MAKE SURE START AND SHUTDOWN DISCRETE IS BEING ACTIVATED FOR CHANNEL A AND B IN ACCORDANCE WITH AMM
U/S
REPAIR AIRFRAME WIRING AS PER AMM
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATION
OK
CHECK CONTINUITY BETWEEN PINS KK AND y ON P1 OR P4 LIMIT 6-12 Ω
CHECK INSULATION RESISTANCE OF PINS KK AND y TO GROUND LIMIT ≥ 10M Ω
U/S
CHECK CONTINUITY BETWEEN PINS P AND R ON J15 OR J16 LIMIT 6-12 Ω
OK
REPLACE OUTER WIRING HARNESS
SEE SHEET 2
U/S
REPLACE HMU

FOR CHANNEL	CHECK CONNECTORS
A	P1, P15, J15
B	P4, P16, J16

Pre-SB24434/Post-SB24514 C31708C

MFD Codes with LRU Prefix 3
Figure 103 (Sheet 1 of 12)



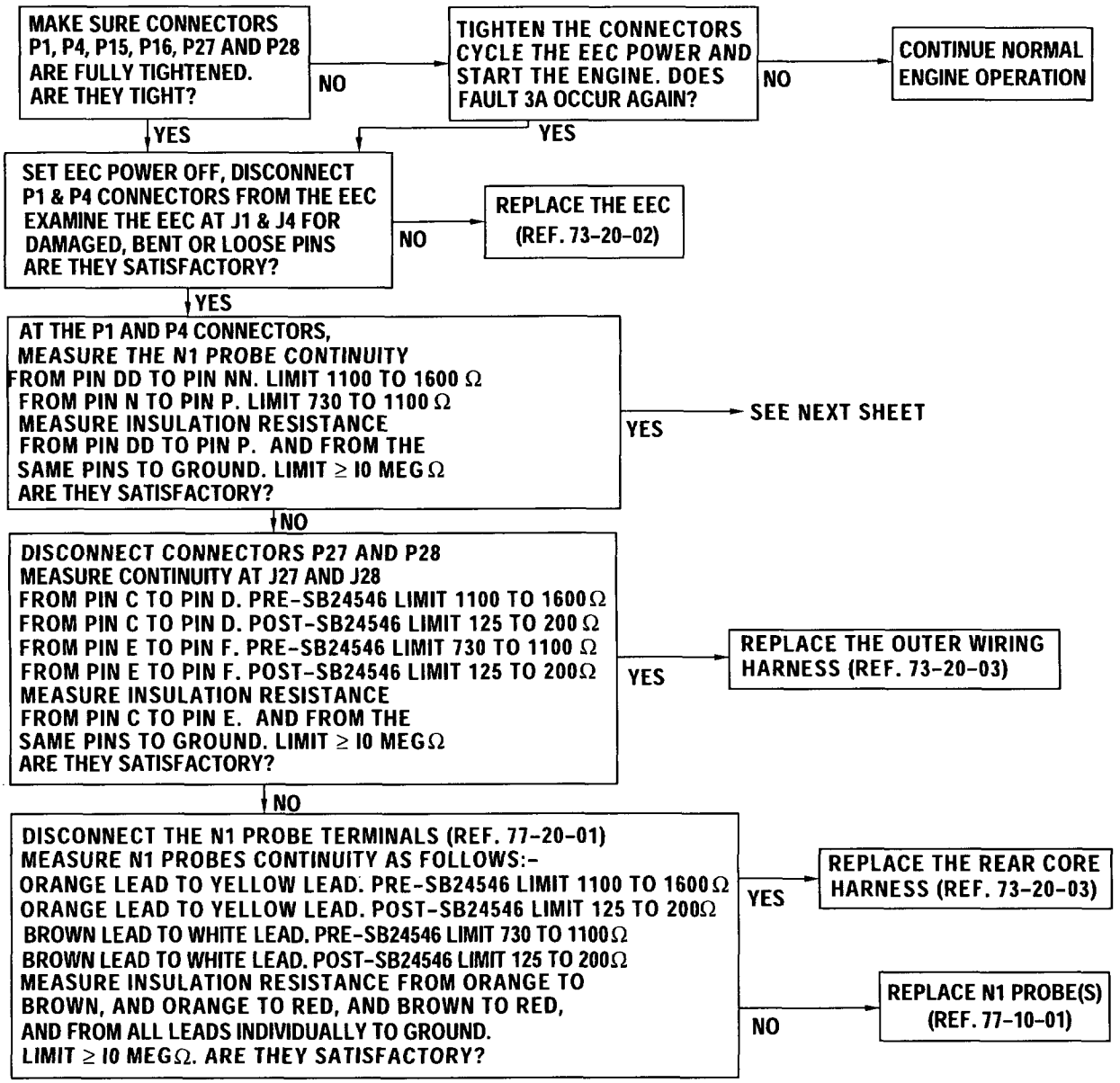
Pre-SB24434/Post-SB24514 C33714

MFD Codes with LRU Prefix 3
Figure 103 (Sheet 2)

FAULT CODE	FAULT	FAULT LEVEL
3A	OVERSPEED DRIVE	3

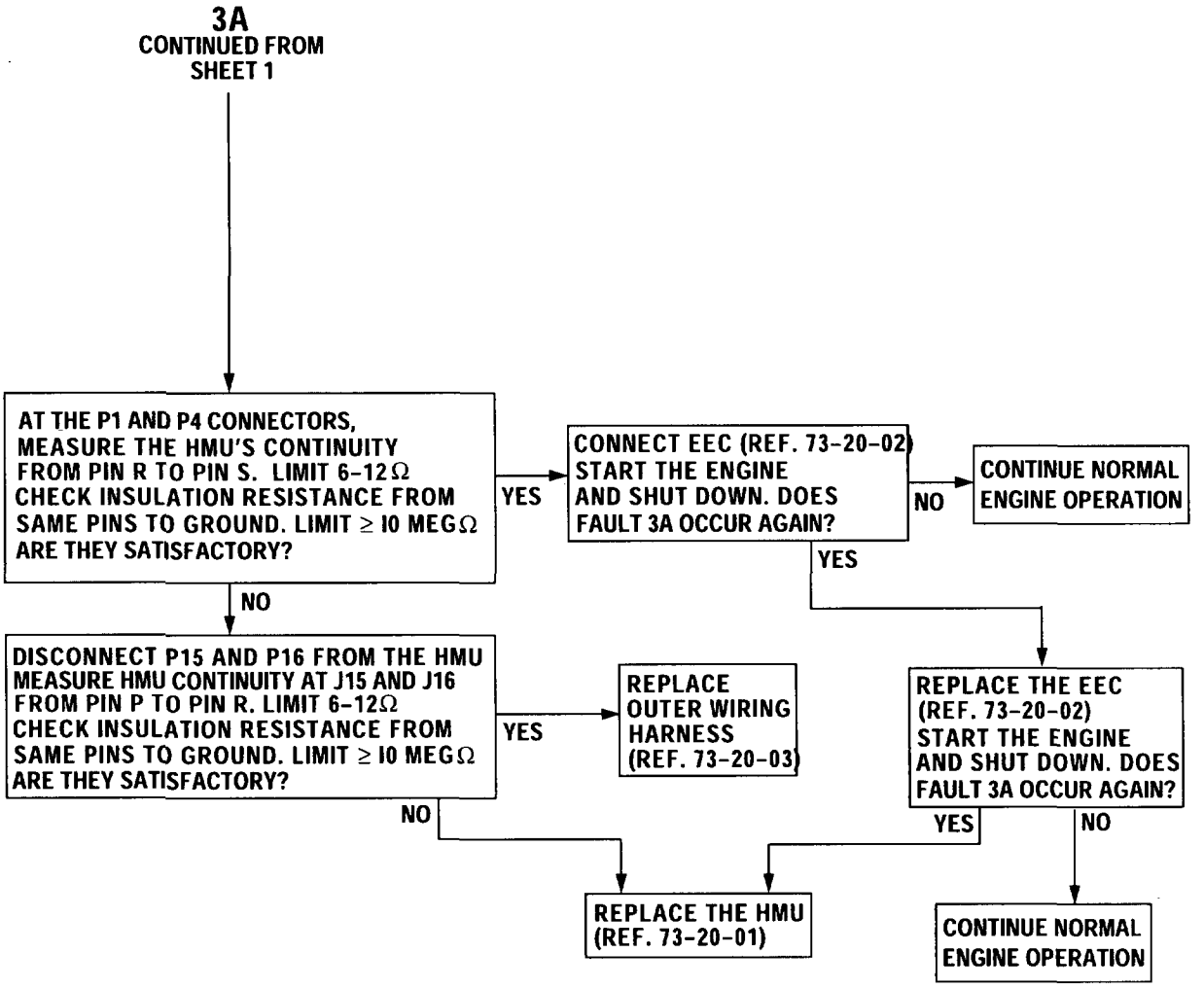
EFFECTS ON SYSTEM - POSSIBLE ENGINE SHUTDOWN OR LOSS OF OVERSPEED PROTECTION

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P15, P16, P27 AND P28 ARE FULLY TIGHTENED. ARE THEY TIGHT?
NO
TIGHTEN THE CONNECTORS CYCLE THE EEC POWER AND START THE ENGINE. DOES FAULT 3A OCCUR AGAIN?
NO
CONTINUE NORMAL ENGINE OPERATION
YES
YES
SET EEC POWER OFF, DISCONNECT P1 & P4 CONNECTORS FROM THE EEC EXAMINE THE EEC AT J1 & J4 FOR DAMAGED, BENT OR LOOSE PINS ARE THEY SATISFACTORY?
NO
REPLACE THE EEC (REF. 73-20-02)
YES
AT THE P1 AND P4 CONNECTORS, MEASURE THE N1 PROBE CONTINUITY FROM PIN DD TO PIN NN. LIMIT 1100 TO 1600 Ω FROM PIN N TO PIN P. LIMIT 730 TO 1100 Ω MEASURE INSULATION RESISTANCE FROM PIN DD TO PIN P. AND FROM THE SAME PINS TO GROUND. LIMIT ≥ 10 MEG Ω ARE THEY SATISFACTORY?
YES
SEE NEXT SHEET
NO
DISCONNECT CONNECTORS P27 AND P28 MEASURE CONTINUITY AT J27 AND J28 FROM PIN C TO PIN D. PRE-SB24546 LIMIT 1100 TO 1600 Ω FROM PIN C TO PIN D. POST-SB24546 LIMIT 125 TO 200 Ω FROM PIN E TO PIN F. PRE-SB24546 LIMIT 730 TO 1100 Ω FROM PIN E TO PIN F. POST-SB24546 LIMIT 125 TO 200Ω MEASURE INSULATION RESISTANCE FROM PIN C TO PIN E. AND FROM THE SAME PINS TO GROUND. LIMIT ≥ 10 MEG Ω ARE THEY SATISFACTORY?
YES
REPLACE THE OUTER WIRING HARNESS (REF. 73-20-03)
NO
DISCONNECT THE N1 PROBE TERMINALS (REF. 77-20-01) MEASURE N1 PROBES CONTINUITY AS FOLLOWS:- ORANGE LEAD TO YELLOW LEAD. PRE-SB24546 LIMIT 1100 TO 1600 Ω ORANGE LEAD TO YELLOW LEAD. POST-SB24546 LIMIT 125 TO 200Ω BROWN LEAD TO WHITE LEAD. PRE-SB24546 LIMIT 730 TO 1100 Ω BROWN LEAD TO WHITE LEAD. POST-SB24546 LIMIT 125 TO 200Ω MEASURE INSULATION RESISTANCE FROM ORANGE TO BROWN, AND ORANGE TO RED, AND BROWN TO RED, AND FROM ALL LEADS INDIVIDUALLY TO GROUND. LIMIT ≥ 10 MEG Ω. ARE THEY SATISFACTORY?
YES
REPLACE THE REAR CORE HARNESS (REF. 73-20-03)
NO
REPLACE N1 PROBE(S) (REF. 77-10-01)

Post-SB24434/Pre-SB24514 C96691B

MFD Codes with LRU Prefix 3
Figure 103 (Sheet 3)


3A
CONTINUED FROM
SHEET 1
AT THE P1 AND P4 CONNECTORS, MEASURE THE HMU'S CONTINUITY FROM PIN R TO PIN S. LIMIT 6-12Ω CHECK INSULATION RESISTANCE FROM SAME PINS TO GROUND. LIMIT ≥ 10 MEGΩ ARE THEY SATISFACTORY?
YES
CONNECT EEC (REF. 73-20-02) START THE ENGINE AND SHUT DOWN. DOES FAULT 3A OCCUR AGAIN?
NO
CONTINUE NORMAL ENGINE OPERATION
YES
NO
DISCONNECT P15 AND P16 FROM THE HMU MEASURE HMU CONTINUITY AT J15 AND J16 FROM PIN P TO PIN R. LIMIT 6-12Ω CHECK INSULATION RESISTANCE FROM SAME PINS TO GROUND. LIMIT ≥ 10 MEGΩ ARE THEY SATISFACTORY?
YES
REPLACE OUTER WIRING HARNESS (REF. 73-20-03)
REPLACE THE EEC (REF. 73-20-02) START THE ENGINE AND SHUT DOWN. DOES FAULT 3A OCCUR AGAIN?
NO
YES
NO
REPLACE THE HMU (REF. 73-20-01)
CONTINUE NORMAL ENGINE OPERATION

FOR CHANNEL	CHECK CONNECTORS
A	P1, P15, P27
B	P4, P16, P28

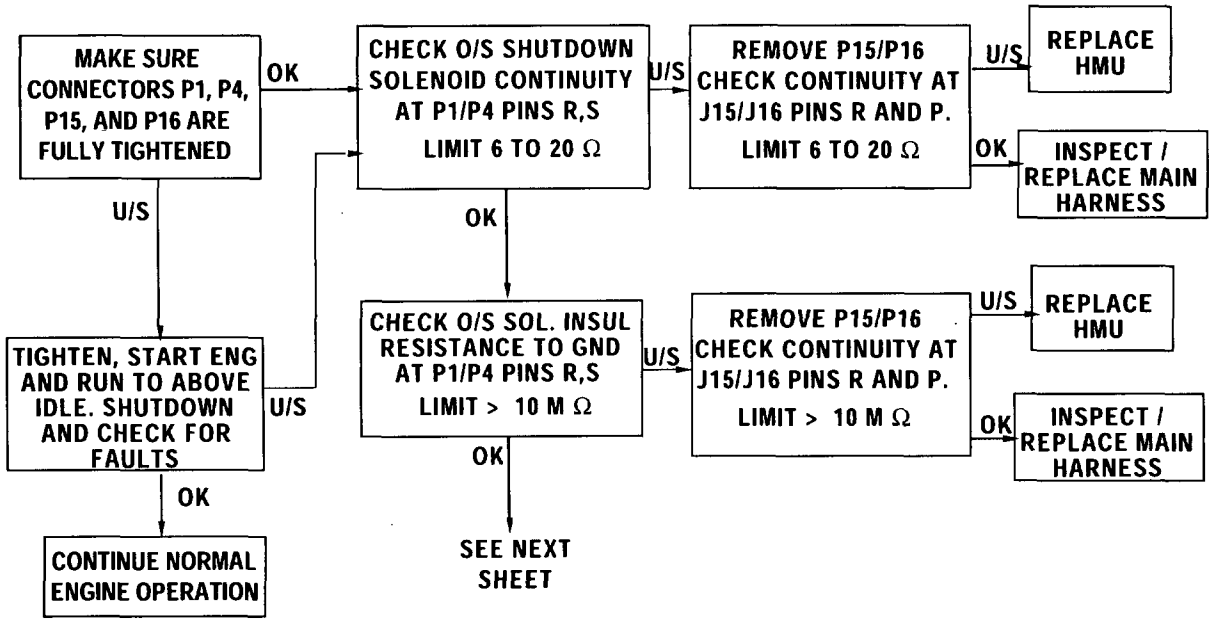
Post-SB24434/Pre-SB24514 C96692

MFD Codes with LRU Prefix 3
Figure 103 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
3B	OVERSPEED START-UP	3

EFFECTS ON SYSTEM - POSSIBLE ENGINE SHUTDOWN AT 40% TO 46% N2

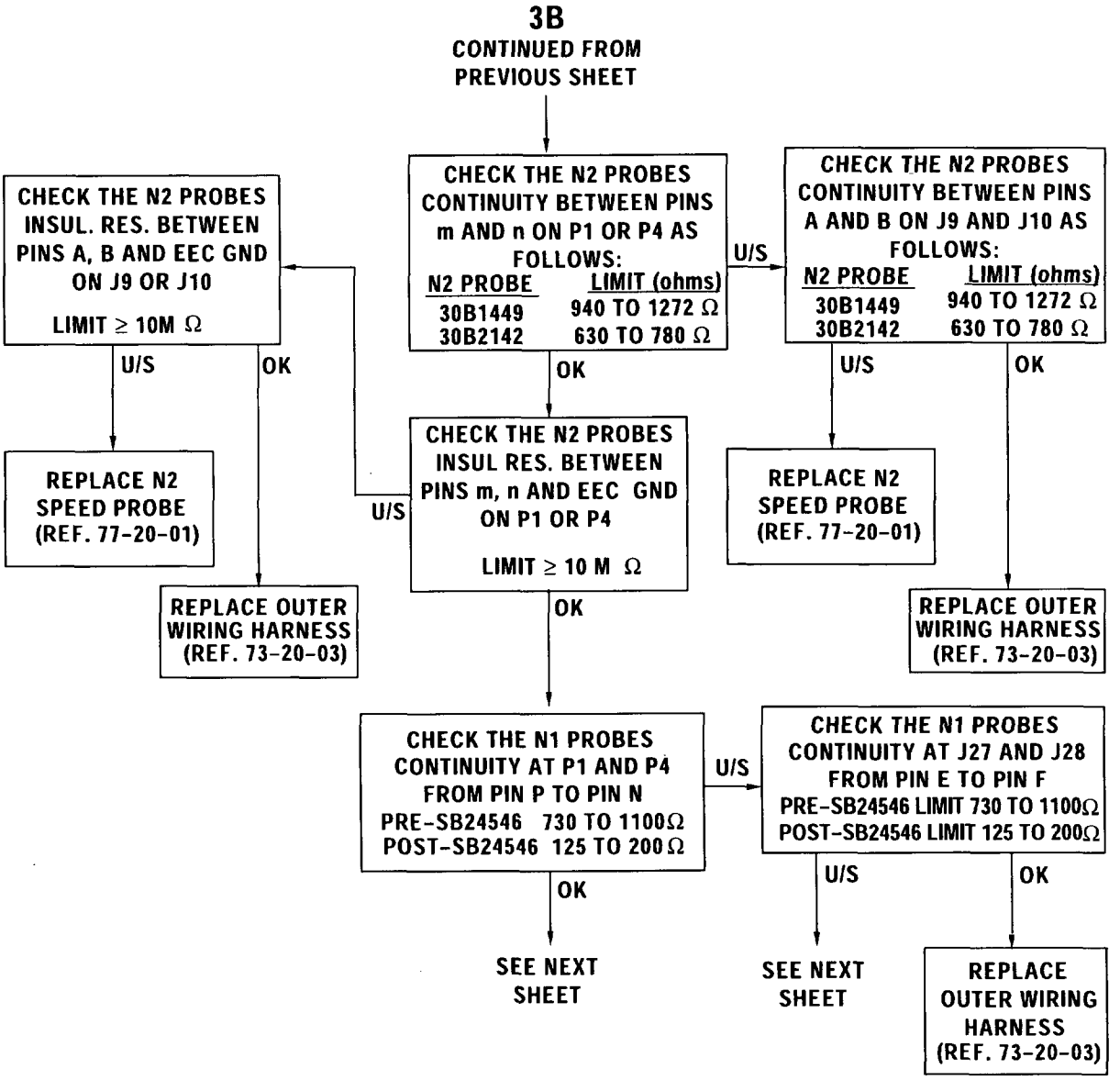
CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P15, AND P16 ARE FULLY TIGHTENED
OK
U/S
TIGHTEN, START ENG AND RUN TO ABOVE IDLE. SHUTDOWN AND CHECK FOR FAULTS
U/S
OK
CONTINUE NORMAL ENGINE OPERATION
CHECK O/S SHUTDOWN SOLENOID CONTINUITY AT P1/P4 PINS R,S
LIMIT 6 TO 20 Ω
U/S
REMOVE P15/P16 CHECK CONTINUITY AT J15/J16 PINS R AND P.
LIMIT 6 TO 20 Ω
U/S
REPLACE HMU
OK
INSPECT / REPLACE MAIN HARNESS
OK
CHECK O/S SOL. INSUL RESISTANCE TO GND AT P1/P4 PINS R,S
LIMIT > 10 M Ω
U/S
REMOVE P15/P16 CHECK CONTINUITY AT J15/J16 PINS R AND P.
LIMIT > 10 M Ω
U/S
REPLACE HMU
OK
INSPECT / REPLACE MAIN HARNESS
OK
SEE NEXT SHEET

FOR CHANNEL	CHECK CONNECTORS
A	P1, P15, J15
B	P4, P16, J16

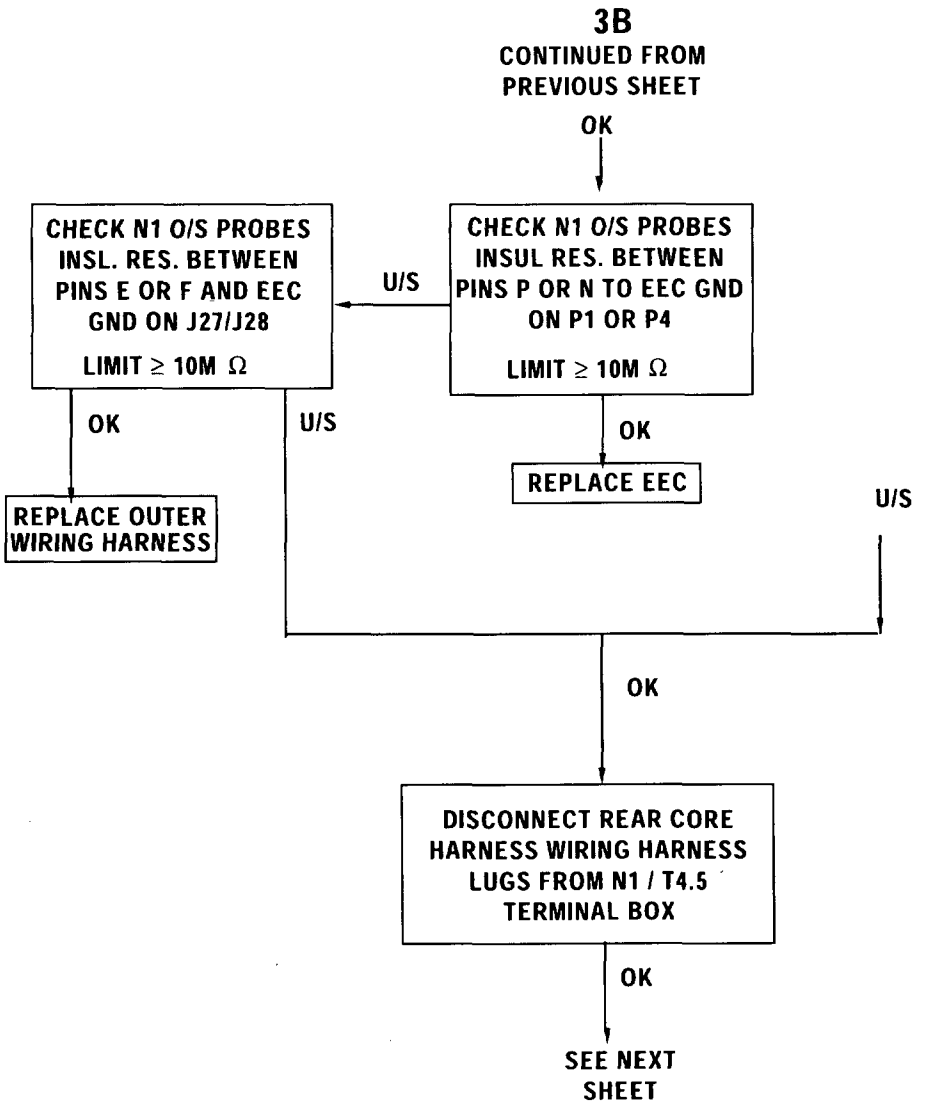
Post-SB24434/Pre-SB24514 C62999

MFD Codes with LRU Prefix 3
Figure 103 (Sheet 5)


3B
CONTINUED FROM PREVIOUS SHEET
CHECK THE N2 PROBES CONTINUITY BETWEEN PINS m AND n ON P1 OR P4 AS FOLLOWS:
N2 PROBE
LIMIT (ohms)
30B1449
940 TO 1272 Ω
30B2142
630 TO 780 Ω
U/S
OK
CHECK THE N2 PROBES CONTINUITY BETWEEN PINS A AND B ON J9 AND J10 AS FOLLOWS:
N2 PROBE
LIMIT (ohms)
30B1449
940 TO 1272 Ω
30B2142
630 TO 780 Ω
U/S
OK
CHECK THE N2 PROBES INSUL. RES. BETWEEN PINS A, B AND EEC GND ON J9 OR J10
LIMIT ≥ 10M Ω
U/S
OK
REPLACE N2 SPEED PROBE (REF. 77-20-01)
REPLACE OUTER WIRING HARNESS (REF. 73-20-03)
CHECK THE N2 PROBES INSUL RES. BETWEEN PINS m, n AND EEC GND ON P1 OR P4
LIMIT ≥ 10 M Ω
U/S
OK
REPLACE N2 SPEED PROBE (REF. 77-20-01)
REPLACE OUTER WIRING HARNESS (REF. 73-20-03)
CHECK THE N1 PROBES CONTINUITY AT P1 AND P4 FROM PIN P TO PIN N
PRE-SB24546 730 TO 1100Ω
POST-SB24546 125 TO 200Ω
U/S
OK
CHECK THE N1 PROBES CONTINUITY AT J27 AND J28 FROM PIN E TO PIN F
PRE-SB24546 LIMIT 730 TO 1100Ω
POST-SB24546 LIMIT 125 TO 200Ω
U/S
OK
SEE NEXT SHEET
SEE NEXT SHEET
REPLACE OUTER WIRING HARNESS (REF. 73-20-03)

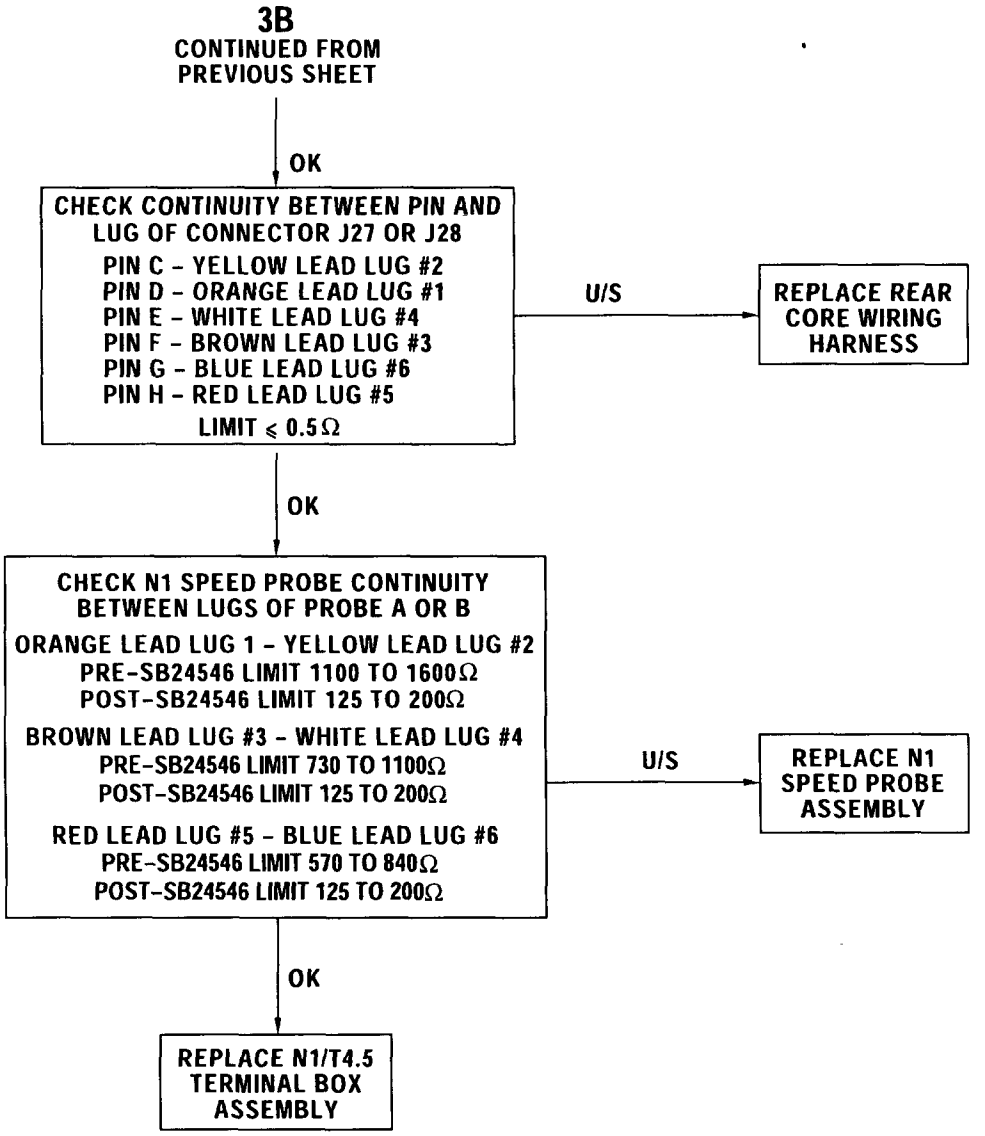
Post-SB24434/Pre-SB24514 C63263B

MFD Codes with LRU Prefix 3
Figure 103 (Sheet 6)



Post-SB24434/Pre-SB24514 C63265

MFD Codes with LRU Prefix 3
Figure 103 (Sheet 7)


3B
CONTINUED FROM PREVIOUS SHEET
OK
CHECK CONTINUITY BETWEEN PIN AND LUG OF CONNECTOR J27 OR J28
PIN C - YELLOW LEAD LUG #2
PIN D - ORANGE LEAD LUG #1
PIN E - WHITE LEAD LUG #4
PIN F - BROWN LEAD LUG #3
PIN G - BLUE LEAD LUG #6
PIN H - RED LEAD LUG #5
LIMIT ⩽ 0.5Ω
U/S
REPLACE REAR CORE WIRING HARNESS
OK
CHECK N1 SPEED PROBE CONTINUITY BETWEEN LUGS OF PROBE A OR B
ORANGE LEAD LUG 1 - YELLOW LEAD LUG #2
PRE-SB24546 LIMIT 1100 TO 1600Ω
POST-SB24546 LIMIT 125 TO 200Ω
BROWN LEAD LUG #3 - WHITE LEAD LUG #4
PRE-SB24546 LIMIT 730 TO 1100Ω
POST-SB24546 LIMIT 125 TO 200Ω
RED LEAD LUG #5 - BLUE LEAD LUG #6
PRE-SB24546 LIMIT 570 TO 840Ω
POST-SB24546 LIMIT 125 TO 200Ω
U/S
REPLACE N1 SPEED PROBE ASSEMBLY
OK
REPLACE N1/T4.5 TERMINAL BOX ASSEMBLY

FOR CHANNEL	CHECK CONNECTORS
A	P1,J27
B	P4,J28

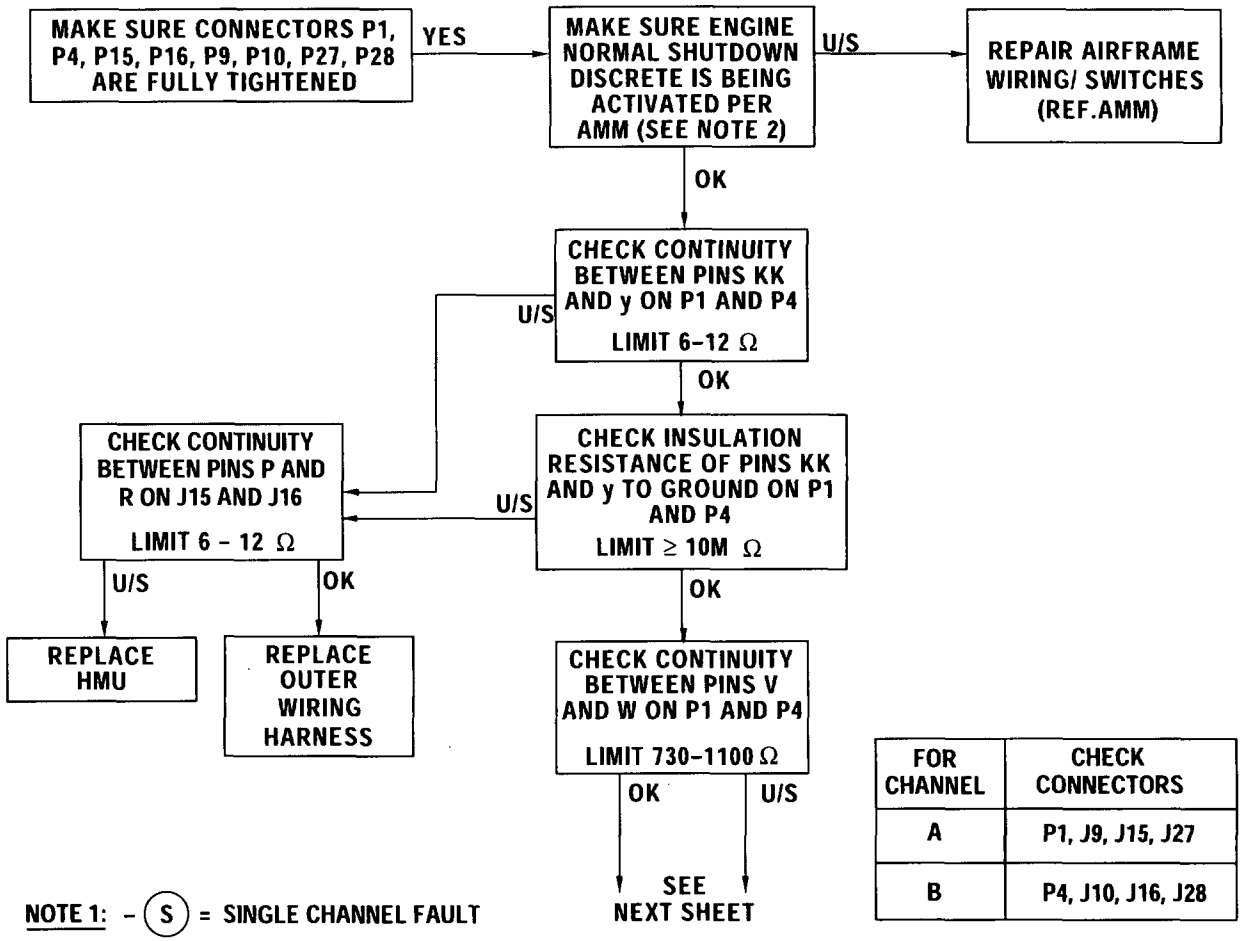
Post-SB24434/Pre-SB24514 C63561B

MFD Codes with LRU Prefix 3
Figure 103 (Sheet 8)

MFD CODE	FAULT	FAULT LEVEL
3C	OVERSPEED SHUTDOWN	3

EFFECTS ON SYSTEM - (S) LOSS OF HARDWARE OVERSPEED PROTECTION

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P15, P16, P9, P10, P27, P28 ARE FULLY TIGHTENED
YES
MAKE SURE ENGINE NORMAL SHUTDOWN DISCRETE IS BEING ACTIVATED PER AMM (SEE NOTE 2)
U/S
REPAIR AIRFRAME WIRING/ SWITCHES (REF.AMM)
OK
CHECK CONTINUITY BETWEEN PINS KK AND y ON P1 AND P4
LIMIT 6-12 Ω
U/S
OK
CHECK INSULATION RESISTANCE OF PINS KK AND y TO GROUND ON P1 AND P4
LIMIT ≥ 10M Ω
U/S
CHECK CONTINUITY BETWEEN PINS P AND R ON J15 AND J16
LIMIT 6 - 12 Ω
U/S
OK
REPLACE HMU
REPLACE OUTER WIRING HARNESS
OK
CHECK CONTINUITY BETWEEN PINS V AND W ON P1 AND P4
LIMIT 730-1100 Ω
OK
U/S
SEE NEXT SHEET

FOR CHANNEL	CHECK CONNECTORS
A	P1, J9, J15, J27
B	P4, J10, J16, J28

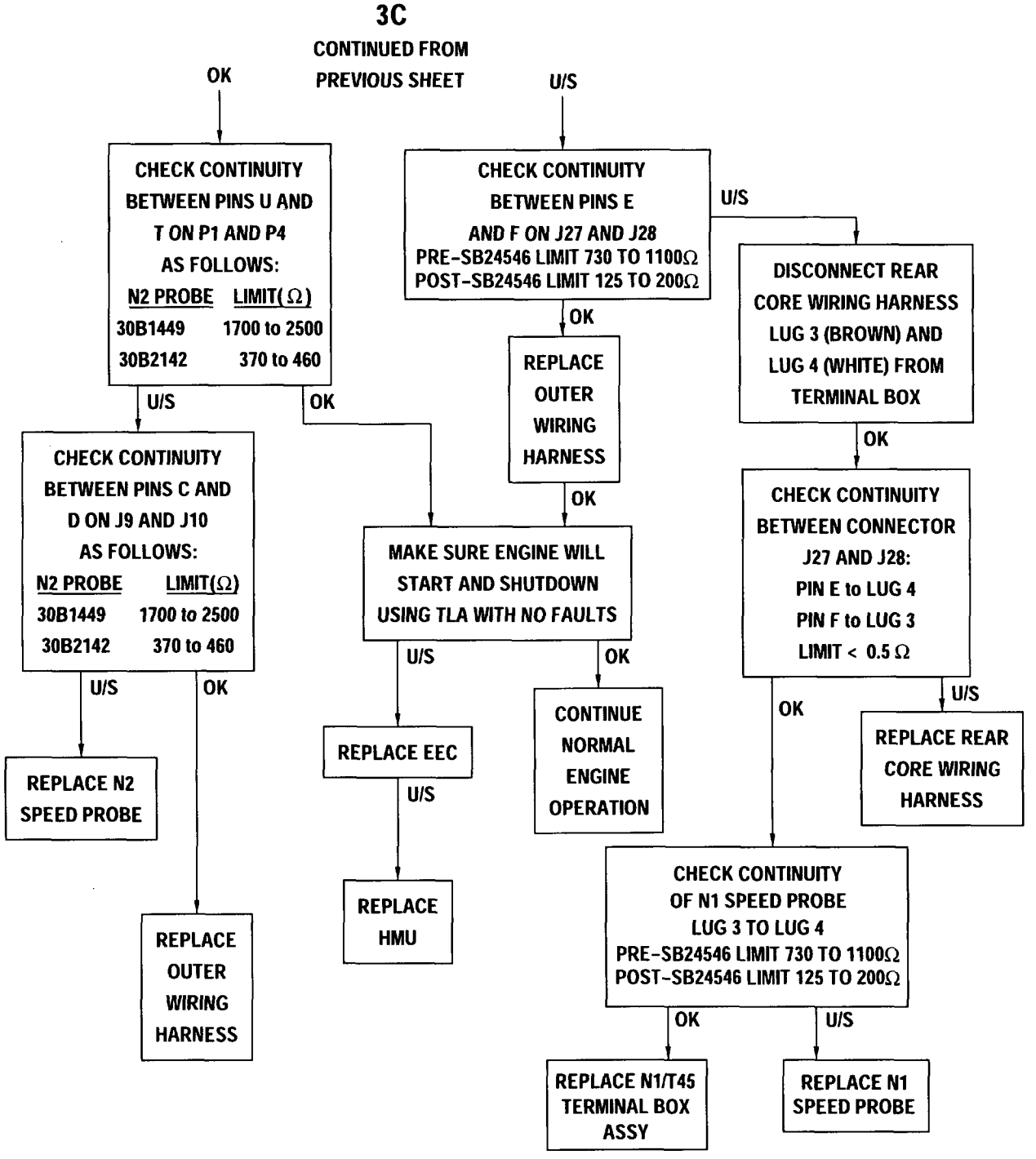
NOTE 1: - (S) = SINGLE CHANNEL FAULT

NOTE 2: - PERFORM TROUBLESHOOTING ON BOTH CHANNELS. FAULT CAN BE ON EITHER OR BOTH CHANNELS. USE THE EDS REAL TIME DISPLAY OF STATUS WORDS TO MAKE SURE THAT "QBOS" CHANGES FROM 0 TO 1 WHEN SHUTDOWN IS COMMANDED. IF "QBOS" DOES NOT CHANGE FROM 0 TO 1 ON BOTH CHANNELS WITHIN 5 SECONDS OF THE SHUTDOWN COMMAND, THE AIRFRAME WIRING AND/OR SHUTDOWN SWITCHES ARE AT FAULT AND MUST BE REPAIRED (REF. AMM).

Pre-SB24434/Post-SB24514 C31586E

MFD Codes with LRU Prefix 3
Figure 103 (Sheet 9)

P&WC Proprietary Information. Subject to the restrictions on the title page.


3C
CONTINUED FROM PREVIOUS SHEET
OK
U/S
CHECK CONTINUITY BETWEEN PINS U AND T ON P1 AND P4 AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 1700 to 2500
30B2142 370 to 460
U/S
OK
CHECK CONTINUITY BETWEEN PINS C AND D ON J9 AND J10 AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 1700 to 2500
30B2142 370 to 460
U/S
OK
REPLACE N2 SPEED PROBE
REPLACE OUTER WIRING HARNESS
CHECK CONTINUITY BETWEEN PINS E AND F ON J27 AND J28
PRE-SB24546 LIMIT 730 TO 1100Ω
POST-SB24546 LIMIT 125 TO 200Ω
U/S
OK
REPLACE OUTER WIRING HARNESS
OK
MAKE SURE ENGINE WILL START AND SHUTDOWN USING TLA WITH NO FAULTS
U/S
OK
REPLACE EEC
U/S
REPLACE HMU
CONTINUE NORMAL ENGINE OPERATION
U/S
DISCONNECT REAR CORE WIRING HARNESS LUG 3 (BROWN) AND LUG 4 (WHITE) FROM TERMINAL BOX
OK
CHECK CONTINUITY BETWEEN CONNECTOR J27 AND J28:
PIN E to LUG 4
PIN F to LUG 3
LIMIT < 0.5 Ω
OK
U/S
REPLACE REAR CORE WIRING HARNESS
CHECK CONTINUITY OF N1 SPEED PROBE LUG 3 TO LUG 4
PRE-SB24546 LIMIT 730 TO 1100Ω
POST-SB24546 LIMIT 125 TO 200Ω
OK
U/S
REPLACE N1/T45 TERMINAL BOX ASSY
REPLACE N1 SPEED PROBE

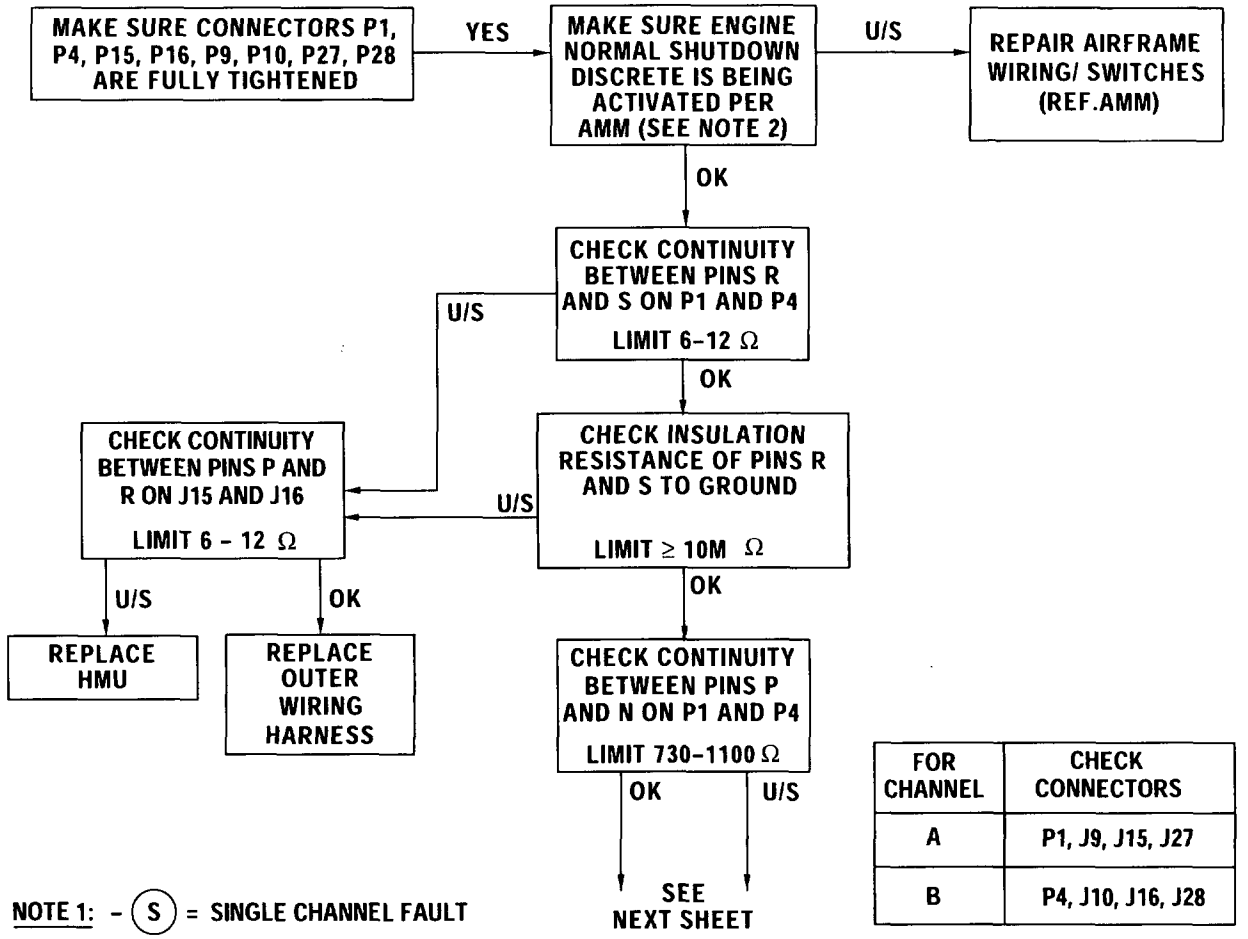
Pre-SB24434/Post-SB24514 C33715A

MFD Codes with LRU Prefix 3
Figure 103 (Sheet 10)

MFD CODE	FAULT	FAULT LEVEL
3C	OVERSPEED SHUTDOWN	3

EFFECTS ON SYSTEM - (S) LOSS OF HARDWARE OVERSPEED PROTECTION

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P15, P16, P9, P10, P27, P28 ARE FULLY TIGHTENED
YES
MAKE SURE ENGINE NORMAL SHUTDOWN DISCRETE IS BEING ACTIVATED PER AMM (SEE NOTE 2)
U/S
REPAIR AIRFRAME WIRING/ SWITCHES (REF.AMM)
OK
CHECK CONTINUITY BETWEEN PINS R AND S ON P1 AND P4
LIMIT 6-12 Ω
U/S
OK
CHECK INSULATION RESISTANCE OF PINS R AND S TO GROUND
LIMIT ≥ 10M Ω
U/S
CHECK CONTINUITY BETWEEN PINS P AND R ON J15 AND J16
LIMIT 6 - 12 Ω
U/S
OK
REPLACE HMU
REPLACE OUTER WIRING HARNESS
OK
CHECK CONTINUITY BETWEEN PINS P AND N ON P1 AND P4
LIMIT 730-1100 Ω
OK
U/S
SEE NEXT SHEET

FOR CHANNEL	CHECK CONNECTORS
A	P1, J9, J15, J27
B	P4, J10, J16, J28

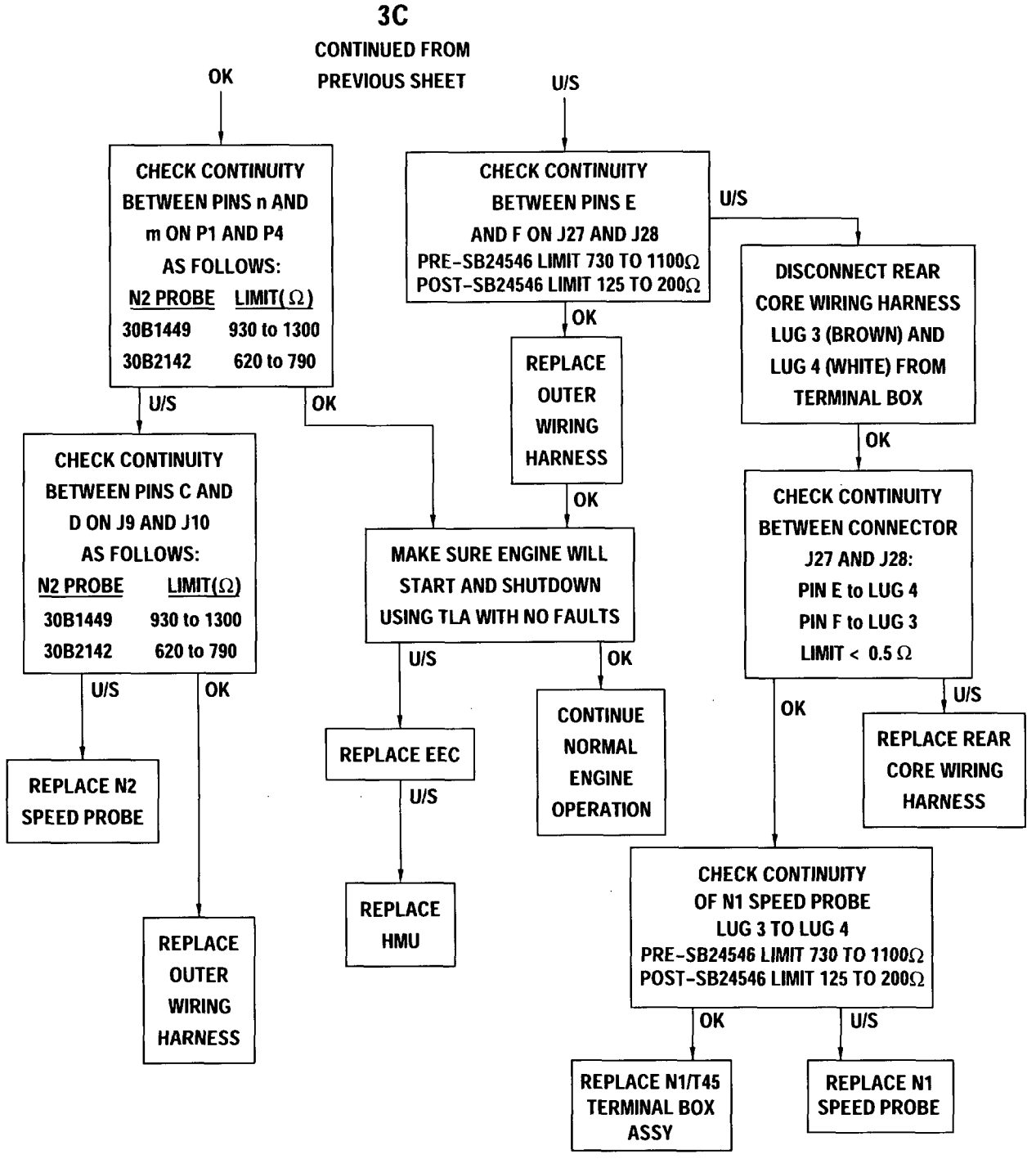
NOTE 1: - (S) = SINGLE CHANNEL FAULT

NOTE 2: - PERFORM TROUBLESHOOTING ON BOTH CHANNELS. FAULT CAN BE ON EITHER OR BOTH CHANNELS. USE THE EDS REAL TIME DISPLAY OF STATUS WORDS TO MAKE SURE THAT "QBOS" CHANGES FROM 0 TO 1 WHEN SHUTDOWN IS COMMANDED. IF "QBOS" DOES NOT CHANGE FROM 0 TO 1 ON BOTH CHANNELS WITHIN 5 SECONDS OF THE SHUTDOWN COMMAND, THE AIRFRAME WIRING AND/OR SHUTDOWN SWITCHES ARE AT FAULT AND MUST BE REPAIRED (REF. AMM).

Post-SB24434/Pre-SB24514 C62158B

MFD Codes with LRU Prefix 3
Figure 103 (Sheet 11)

P&WC Proprietary Information. Subject to the restrictions on the title page.


3C
CONTINUED FROM PREVIOUS SHEET
OK
U/S
CHECK CONTINUITY BETWEEN PINS n AND m ON P1 AND P4 AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 930 to 1300
30B2142 620 to 790
U/S
OK
CHECK CONTINUITY BETWEEN PINS C AND D ON J9 AND J10 AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 930 to 1300
30B2142 620 to 790
U/S
OK
REPLACE N2 SPEED PROBE
REPLACE OUTER WIRING HARNESS
CHECK CONTINUITY BETWEEN PINS E AND F ON J27 AND J28
PRE-SB24546 LIMIT 730 TO 1100Ω
POST-SB24546 LIMIT 125 TO 200Ω
U/S
OK
REPLACE OUTER WIRING HARNESS
OK
MAKE SURE ENGINE WILL START AND SHUTDOWN USING TLA WITH NO FAULTS
U/S
OK
REPLACE EEC
U/S
REPLACE HMU
CONTINUE NORMAL ENGINE OPERATION
DISCONNECT REAR CORE WIRING HARNESS LUG 3 (BROWN) AND LUG 4 (WHITE) FROM TERMINAL BOX
OK
CHECK CONTINUITY BETWEEN CONNECTOR J27 AND J28:
PIN E to LUG 4
PIN F to LUG 3
LIMIT < 0.5 Ω
OK
U/S
REPLACE REAR CORE WIRING HARNESS
CHECK CONTINUITY OF N1 SPEED PROBE LUG 3 TO LUG 4
PRE-SB24546 LIMIT 730 TO 1100Ω
POST-SB24546 LIMIT 125 TO 200Ω
OK
U/S
REPLACE N1/T45 TERMINAL BOX ASSY
REPLACE N1 SPEED PROBE

Post-SB24434/Pre-SB24514 C62159C

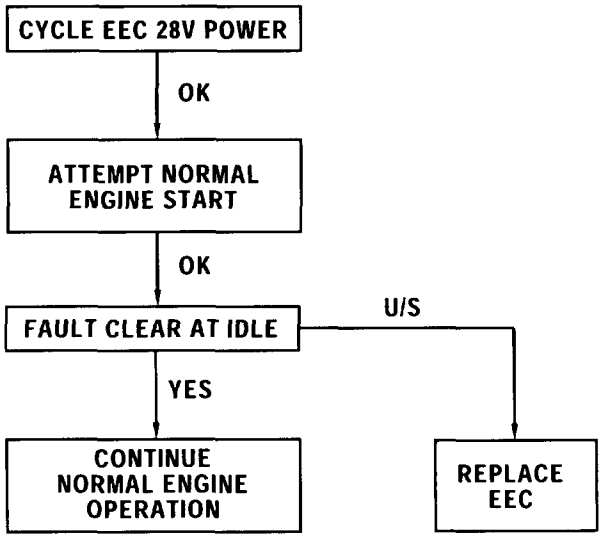
MFD Codes with LRU Prefix 3
Figure 103 (Sheet 12)

MFD CODE	FAULT	FAULT LEVEL
4A	SOFTWARE LANE DISCONNECT	2

EFFECTS ON SYSTEM: - (S) OTHER EEC CHANNEL DOES NOT ACCEPT CONTROL

- (S) CHANNEL IN CONTROL CANNOT GIVE UP CONTROL

CORRECTIVE ACTION



NOTE: - (S) = SINGLE CHANNEL FAULT

C31593B

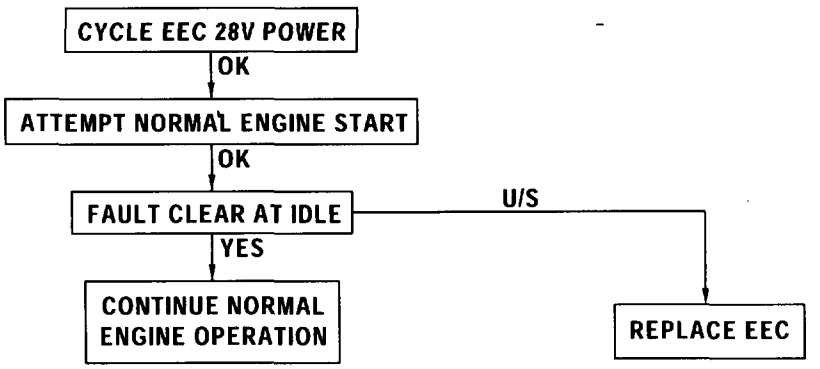
MFD Codes with LRU Prefix 4
Figure 104 (Sheet 1 of 4)

MFD CODE	FAULT	FAULT LEVEL
4B	SOFTWARE LANE TEST DISCONNECT	2
4C	LANE CONNECTED STATUS FAIL	3

EFFECTS ON SYSTEM: 4B - (S) EEC CHANNEL SWITCHOVER TEST DURING ENGINE START-UP FAILS
- (S) EEC CHANNEL SWITCHOVER WILL NOT OCCUR
- (S) EEC REMAINS IN ORIGINAL CHANNEL

EFFECTS ON SYSTEM: 4C - (S) INVALID EEC CHANNEL DISCONNECT STATUS
- (S) EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION



NOTE: - (S) = SINGLE CHANNEL FAULT

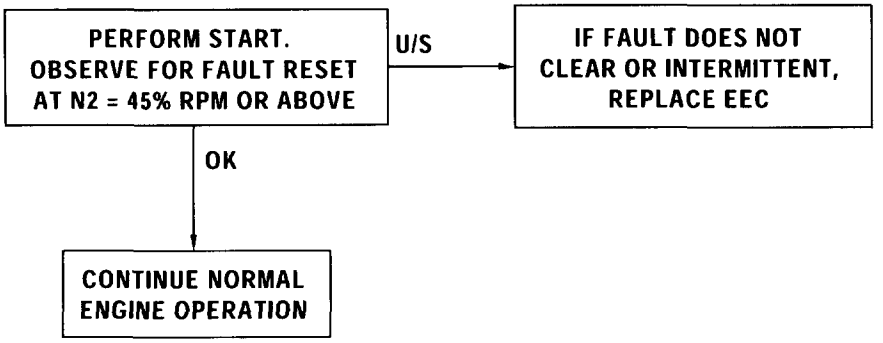
C33386B

MFD Codes with LRU Prefix 4
Figure 104 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
4D	LATENCY FAULT	2

EFFECTS ON SYSTEM: - (S) INVALID EEC CHANNEL DISCONNECT STATUS
- (S) EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION



NOTE: - (S) = SINGLE CHANNEL FAULT

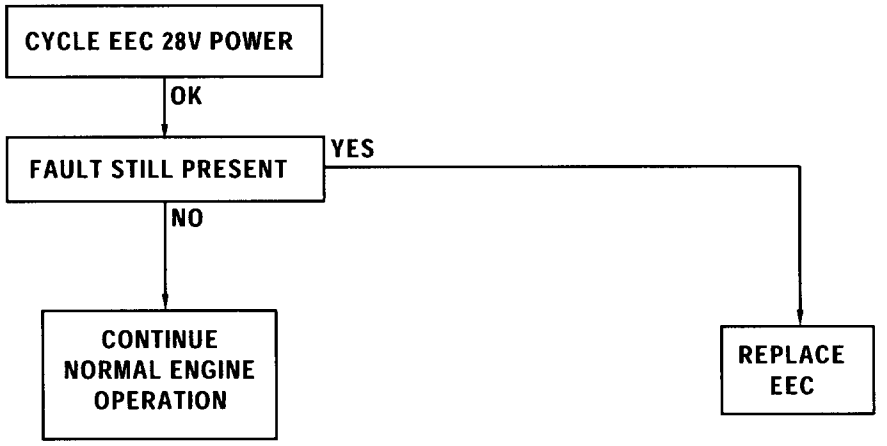
C33388B

MFD Codes with LRU Prefix 4
Figure 104 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
4E	WATCHDOG UNABLE TO DISCONNECT LANE	2

EFFECTS ON SYSTEM - Ⓢ LOSS OF PROTECTION AGAINST INTERNAL EEC FAULTS
- Ⓢ EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION



NOTE: Ⓢ= SINGLE CHANNEL FAULT

Pre-SB24434/Post-SB24514 C33387A

MFD Codes with LRU Prefix 4
Figure 104 (Sheet 4)

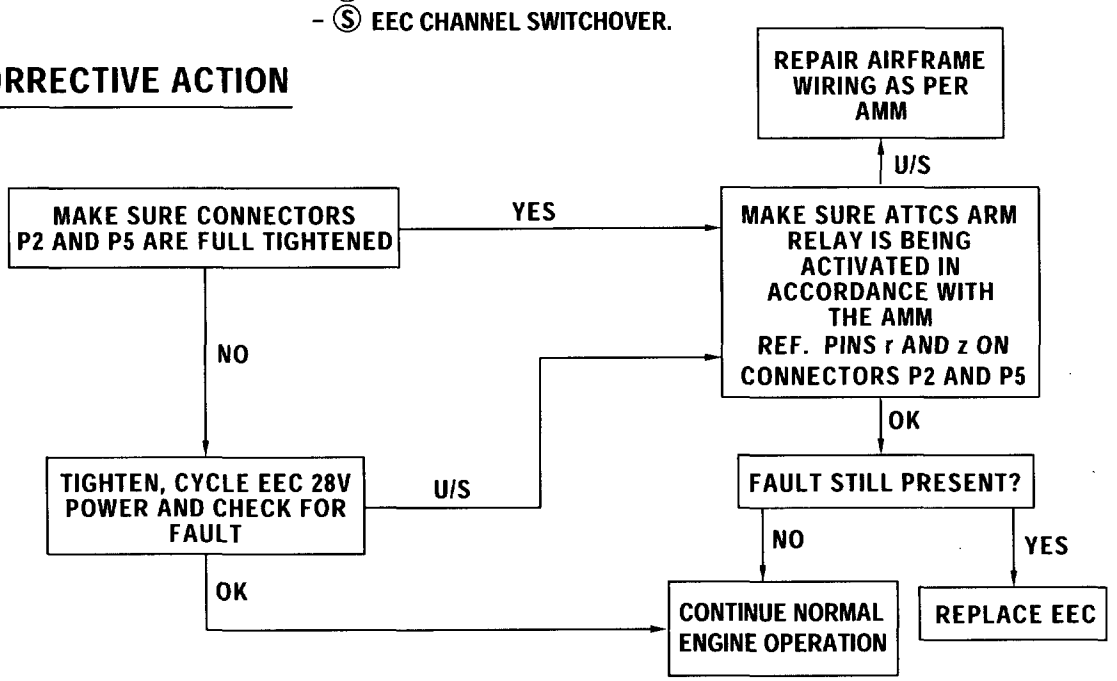
P&WC Proprietary Information. Subject to the restrictions on the title page.

MFD CODE	FAULT	FAULT LEVEL
5A	ATTCS ARMED RELAY (EEC INTERNAL OPEN)	1
5B	ATTCS ARMED RELAY (EEC INTERNAL SHORT OR EXTERNAL OPEN)	1

EFFECTS ON SYSTEM - **5A** - Ⓓ NO ATTCS ARMED AND READY COCKPIT INDICATION.
- Ⓢ OPEN CIRCUIT ON ATTCS ARMED AND READY DRIVER.
- Ⓢ EEC CHANNEL SWITCHOVER.

5B - Ⓢ ATTCS ARMED AND READY COCKPIT INDICATION ON CONTINUOUSLY, EVEN WHEN NOT ARMED OR TESTED.
- Ⓢ SHORT CIRCUIT ON ATTCS ARMED AND READY DRIVER.
- Ⓓ NO ATTCS AVAILABLE.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION


REPAIR AIRFRAME WIRING AS PER AMM
U/S
MAKE SURE CONNECTORS P2 AND P5 ARE FULL TIGHTENED
YES
MAKE SURE ATTCS ARM RELAY IS BEING ACTIVATED IN ACCORDANCE WITH THE AMM REF. PINS r AND z ON CONNECTORS P2 AND P5
NO
OK
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
FAULT STILL PRESENT?
NO
YES
OK
CONTINUE NORMAL ENGINE OPERATION
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32879C

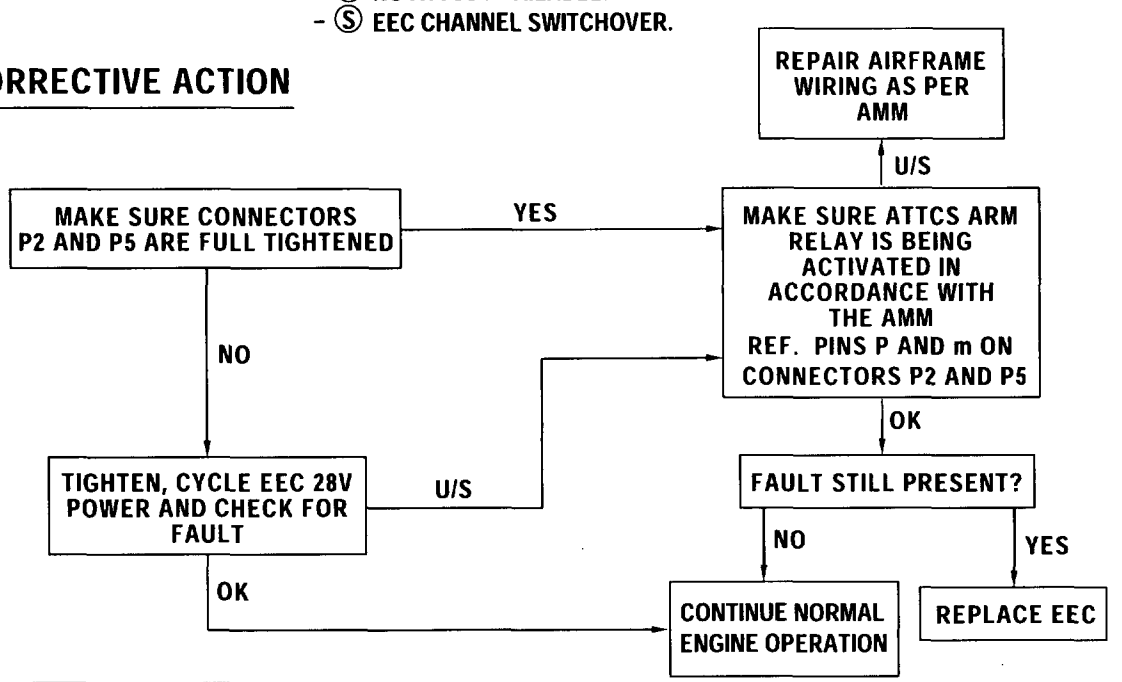
MFD Codes with LRU Prefix 5
Figure 105 (Sheet 1 of 10)

MFD CODE	FAULT	FAULT LEVEL
5A	ATTCS ARMED RELAY (EEC INTERNAL OPEN)	1
5B	ATTCS ARMED RELAY (EEC INTERNAL SHORT OR EXTERNAL OPEN)	1

EFFECTS ON SYSTEM - 5A - Ⓓ NO ATTCS ARMED AND READY COCKPIT INDICATION.
- Ⓢ OPEN CIRCUIT ON ATTCS ARMED AND READY DRIVER.
- Ⓢ EEC CHANNEL SWITCHOVER.

5B - Ⓢ ATTCS ARMED AND READY COCKPIT INDICATION ON CONTINUOUSLY, EVEN WHEN NOT ARMED OR TESTED.
- Ⓢ SHORT CIRCUIT ON ATTCS ARMED AND READY DRIVER.
- Ⓓ NO ATTCS AVAILABLE.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION


REPAIR AIRFRAME WIRING AS PER AMM
U/S
MAKE SURE CONNECTORS P2 AND P5 ARE FULL TIGHTENED
YES
MAKE SURE ATTCS ARM RELAY IS BEING ACTIVATED IN ACCORDANCE WITH THE AMM REF. PINS P AND m ON CONNECTORS P2 AND P5
NO
OK
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
FAULT STILL PRESENT?
NO
YES
OK
CONTINUE NORMAL ENGINE OPERATION
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C63291

MFD Codes with LRU Prefix 5
Figure 105 (Sheet 2)

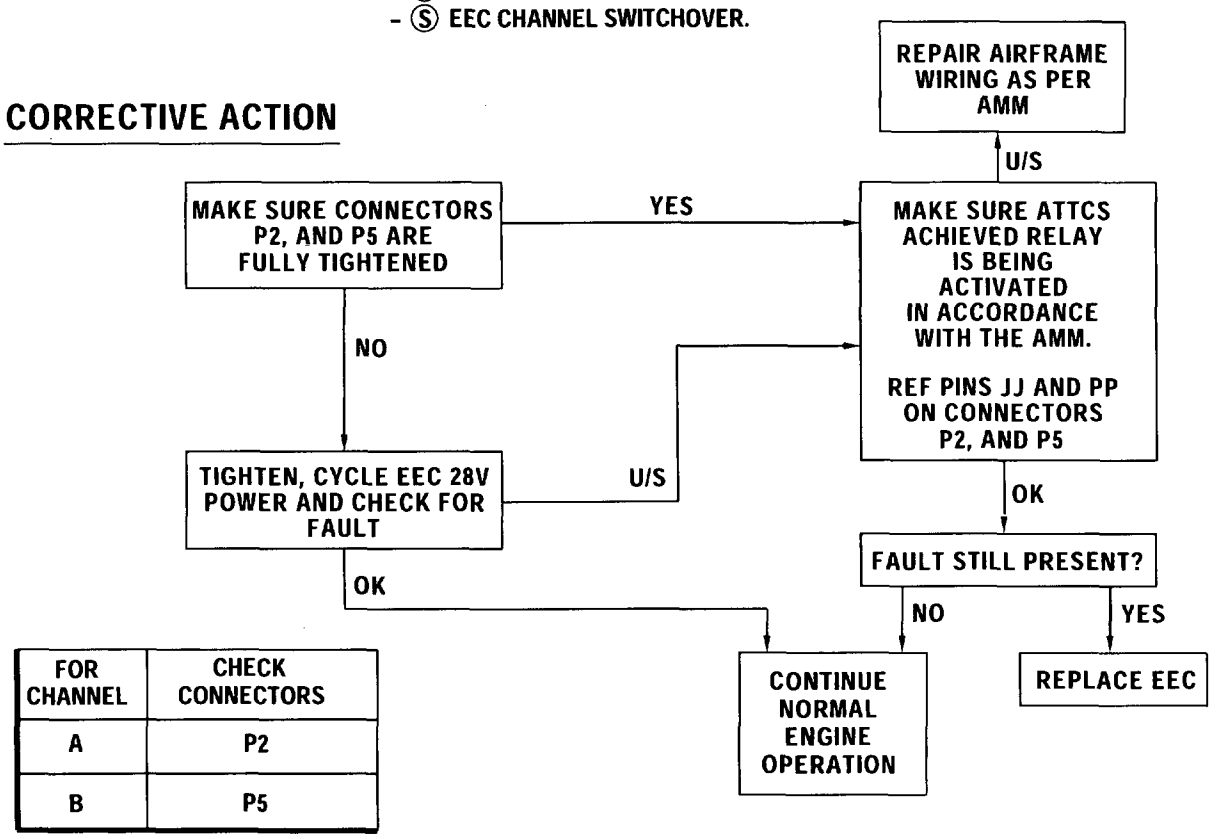
P&WC Proprietary Information. Subject to the restrictions on the title page.

MFD CODE	FAULT	FAULT LEVEL
5C	ATTCS ACHIEVED (EEC INTERNAL OPEN)	1
5D	ATTCS ACHIEVED (EEC INTERNAL SHORT OR EXTERNAL OPEN)	1

EFFECTS ON SYSTEM - 5C - Ⓓ NO ATTCS ACHIEVED COCKPIT INDICATION.
- Ⓢ OPEN CIRCUIT ON ATTCS ACHIEVED DRIVER.
- Ⓢ EEC CHANNEL SWITCHOVER.

5D - Ⓢ ATTCS ACHIEVED COCKPIT INDICATION ON CONTINUOUSLY, EVEN WHEN NOT SELECTED OR ACHIEVED.
- Ⓢ SHORT CIRCUIT ON ATTCS ACHIEVED DRIVER.
- Ⓓ NO ATTCS AVAILABLE.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION


REPAIR AIRFRAME WIRING AS PER AMM
U/S
MAKE SURE CONNECTORS P2, AND P5 ARE FULLY TIGHTENED
YES
MAKE SURE ATTCS ACHIEVED RELAY IS BEING ACTIVATED IN ACCORDANCE WITH THE AMM.
REF PINS JJ AND PP ON CONNECTORS P2, AND P5
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
FAULT STILL PRESENT?
NO
YES
OK
CONTINUE NORMAL ENGINE OPERATION
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32881C

MFD Codes with LRU Prefix 5
Figure 105 (Sheet 3)

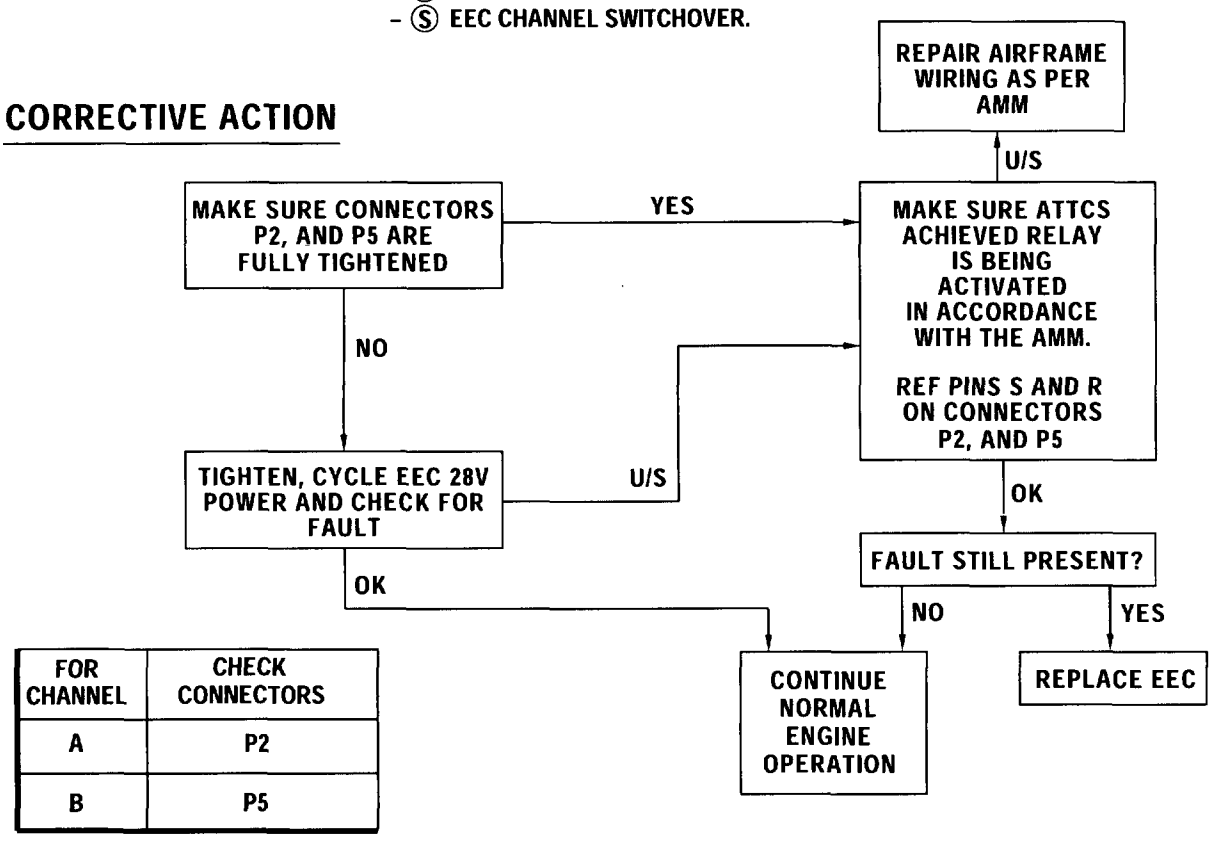
P&WC Proprietary Information. Subject to the restrictions on the title page.

MFD CODE	FAULT	FAULT LEVEL
5C	ATTCS ACHIEVED (EEC INTERNAL OPEN)	1
5D	ATTCS ACHIEVED (EEC INTERNAL SHORT OR EXTERNAL OPEN)	1

EFFECTS ON SYSTEM - 5C - Ⓓ NO ATTCS ACHIEVED COCKPIT INDICATION.
- Ⓢ OPEN CIRCUIT ON ATTCS ACHIEVED DRIVER.
- Ⓢ EEC CHANNEL SWITCHOVER.

5D - Ⓢ ATTCS ACHIEVED COCKPIT INDICATION ON CONTINUOUSLY, EVEN WHEN NOT SELECTED OR ACHIEVED.
- Ⓢ SHORT CIRCUIT ON ATTCS ACHIEVED DRIVER.
- Ⓓ NO ATTCS AVAILABLE.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION


REPAIR AIRFRAME WIRING AS PER AMM
U/S
MAKE SURE CONNECTORS P2, AND P5 ARE FULLY TIGHTENED
YES
MAKE SURE ATTCS ACHIEVED RELAY IS BEING ACTIVATED IN ACCORDANCE WITH THE AMM.
REF PINS S AND R ON CONNECTORS P2, AND P5
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
FAULT STILL PRESENT?
NO
YES
OK
CONTINUE NORMAL ENGINE OPERATION
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C63299

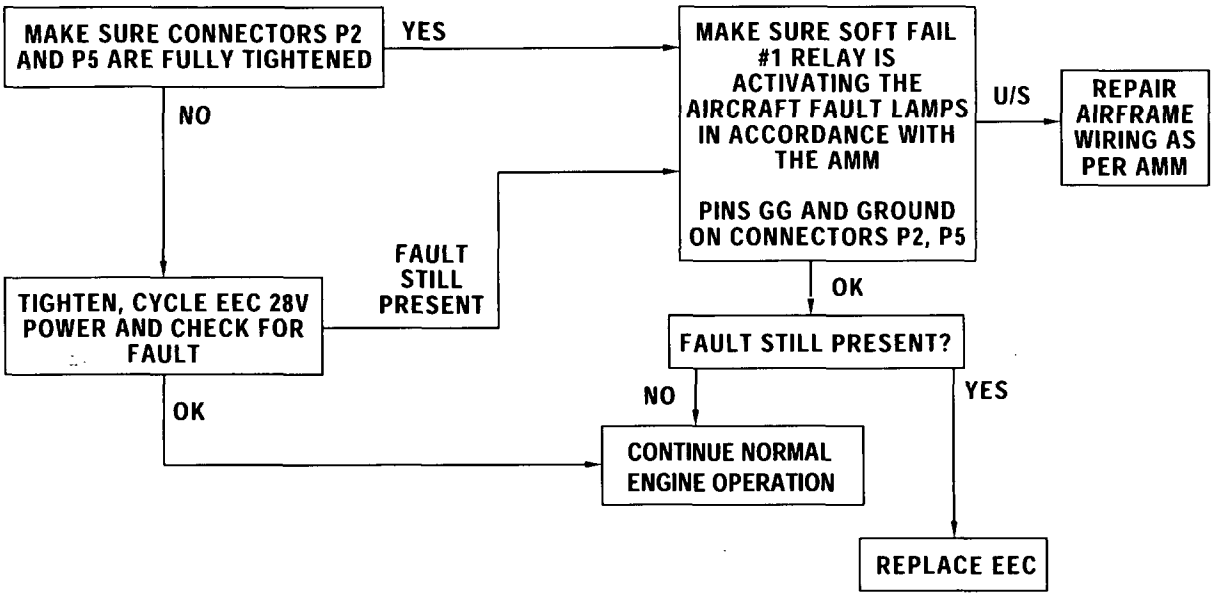
MFD Codes with LRU Prefix 5
Figure 105 (Sheet 4)

P&WC Proprietary Information. Subject to the restrictions on the title page.

MFD CODE	FAULT	FAULT LEVEL
5E	SOFT FAIL 1 DRIVE (EEC INTERNAL OPEN)	2
5F	SOFT FAIL 1 DRIVE (EEC INTERNAL SHORT OR EXTERNAL OPEN)	2

EFFECTS ON SYSTEM - Ⓢ AMBER LAMP COCKPIT INDICATION EVEN IF NO OTHER DISPLAYED MFD FAULTS EXIST.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION


MAKE SURE CONNECTORS P2 AND P5 ARE FULLY TIGHTENED
YES
NO
MAKE SURE SOFT FAIL #1 RELAY IS ACTIVATING THE AIRCRAFT FAULT LAMPS IN ACCORDANCE WITH THE AMM
PINS GG AND GROUND ON CONNECTORS P2, P5
U/S
REPAIR AIRFRAME WIRING AS PER AMM
FAULT STILL PRESENT
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
OK
FAULT STILL PRESENT?
NO
YES
OK
CONTINUE NORMAL ENGINE OPERATION
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ= SINGLE CHANNEL FAULT

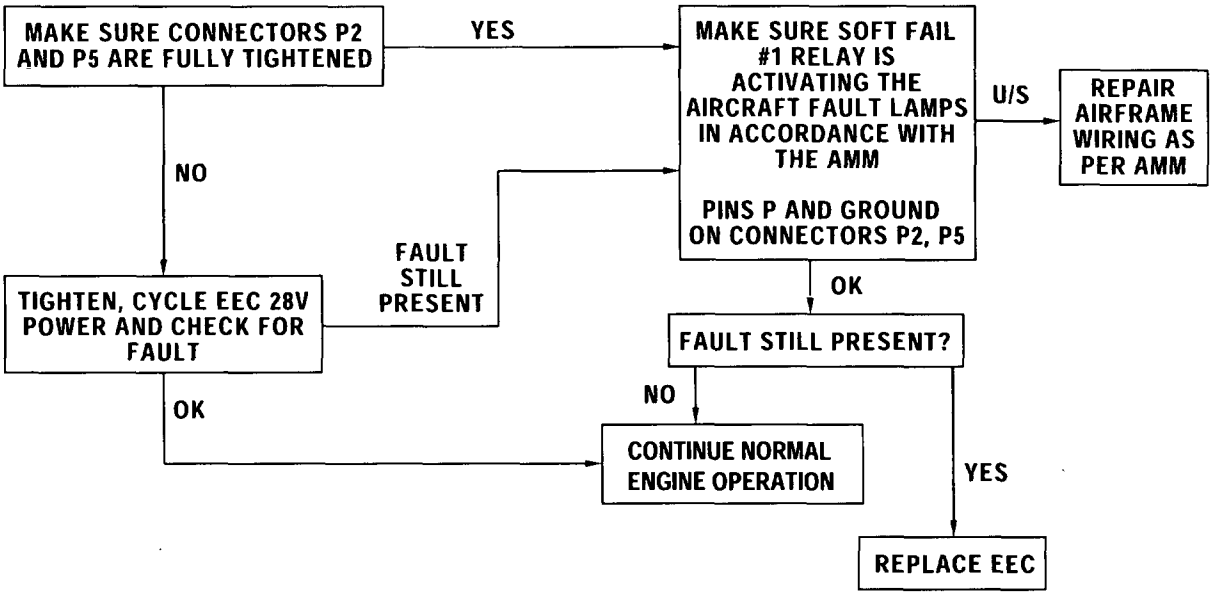
Pre-SB24434/Post-SB24514 C32883C

MFD Codes with LRU Prefix 5
Figure 105 (Sheet 5)

MFD CODE	FAULT	FAULT LEVEL
5E	SOFT FAIL 1 DRIVE (EEC INTERNAL OPEN)	2
5F	SOFT FAIL 1 DRIVE (EEC INTERNAL SHORT OR EXTERNAL OPEN)	2

EFFECTS ON SYSTEM - Ⓢ AMBER LAMP COCKPIT INDICATION EVEN IF NO OTHER DISPLAYED MFD FAULTS EXIST.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION


MAKE SURE CONNECTORS P2 AND P5 ARE FULLY TIGHTENED
YES
MAKE SURE SOFT FAIL #1 RELAY IS ACTIVATING THE AIRCRAFT FAULT LAMPS IN ACCORDANCE WITH THE AMM
PINS P AND GROUND ON CONNECTORS P2, P5
U/S
REPAIR AIRFRAME WIRING AS PER AMM
NO
FAULT STILL PRESENT
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
OK
FAULT STILL PRESENT?
NO
CONTINUE NORMAL ENGINE OPERATION
YES
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ= SINGLE CHANNEL FAULT

Post-SB24434/Pre-SB24514 C63300

MFD Codes with LRU Prefix 5
Figure 105 (Sheet 6)

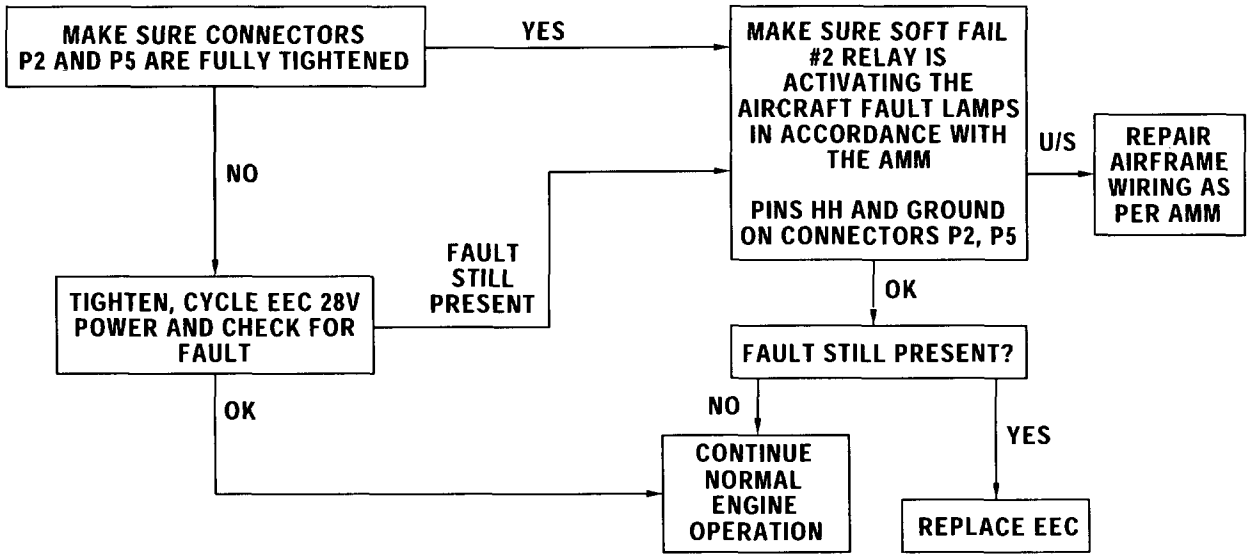
P&WC Proprietary Information. Subject to the restrictions on the title page.

MFD CODE	FAULT	FAULT LEVEL
5G	SOFT FAIL 2 DRIVE (EEC INTERNAL OPEN)	1
5H	SOFT FAIL 2 DRIVE (EEC INTERNAL SHORT OR EXTERNAL OPEN)	1

EFFECTS ON SYSTEM - Ⓢ CONTINUOUS AMBER LAMP COCKPIT INDICATION EVEN IF NO OTHER DISPLAYED MFD FAULTS EXIST WITH 5G, BUT WHITE LAMP WITH 5H.

CORRECTIVE ACTION

- Ⓢ EEC CHANNEL SWITCHOVER.


MAKE SURE CONNECTORS P2 AND P5 ARE FULLY TIGHTENED
YES
MAKE SURE SOFT FAIL #2 RELAY IS ACTIVATING THE AIRCRAFT FAULT LAMPS IN ACCORDANCE WITH THE AMM
PINS HH AND GROUND ON CONNECTORS P2, P5
U/S
REPAIR AIRFRAME WIRING AS PER AMM
NO
FAULT STILL PRESENT
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
OK
FAULT STILL PRESENT?
NO
YES
OK
CONTINUE NORMAL ENGINE OPERATION
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ= SINGLE CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32885E

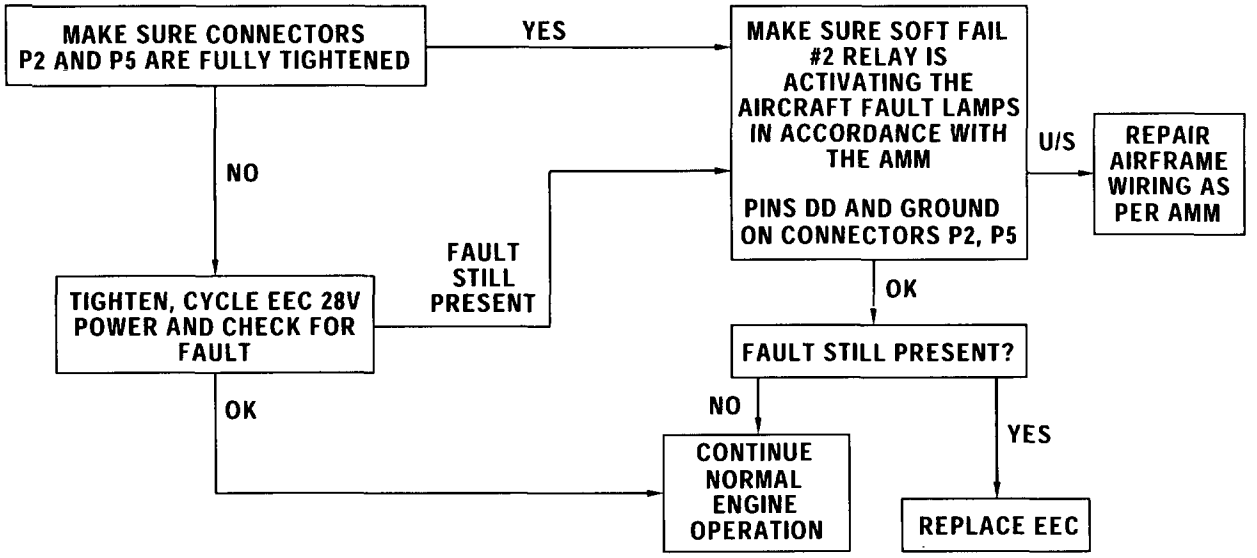
MFD Codes with LRU Prefix 5
Figure 105 (Sheet 7)

MFD CODE	FAULT	FAULT LEVEL
5G	SOFT FAIL 2 DRIVE (EEC INTERNAL OPEN)	1
5H	SOFT FAIL 2 DRIVE (EEC INTERNAL SHORT OR EXTERNAL OPEN)	1

EFFECTS ON SYSTEM - Ⓢ CONTINUOUS AMBER LAMP COCKPIT INDICATION EVEN IF NO OTHER DISPLAYED MFD FAULTS EXIST WITH 5G, BUT WHITE LAMP WITH 5H.

CORRECTIVE ACTION

- Ⓢ EEC CHANNEL SWITCHOVER.


MAKE SURE CONNECTORS P2 AND P5 ARE FULLY TIGHTENED
YES
NO
MAKE SURE SOFT FAIL #2 RELAY IS ACTIVATING THE AIRCRAFT FAULT LAMPS IN ACCORDANCE WITH THE AMM
PINS DD AND GROUND ON CONNECTORS P2, P5
U/S
REPAIR AIRFRAME WIRING AS PER AMM
FAULT STILL PRESENT
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
OK
FAULT STILL PRESENT?
NO
YES
OK
CONTINUE NORMAL ENGINE OPERATION
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ= SINGLE CHANNEL FAULT

Post-SB24434/Pre-SB24514 C63301

MFD Codes with LRU Prefix 5
Figure 105 (Sheet 8)

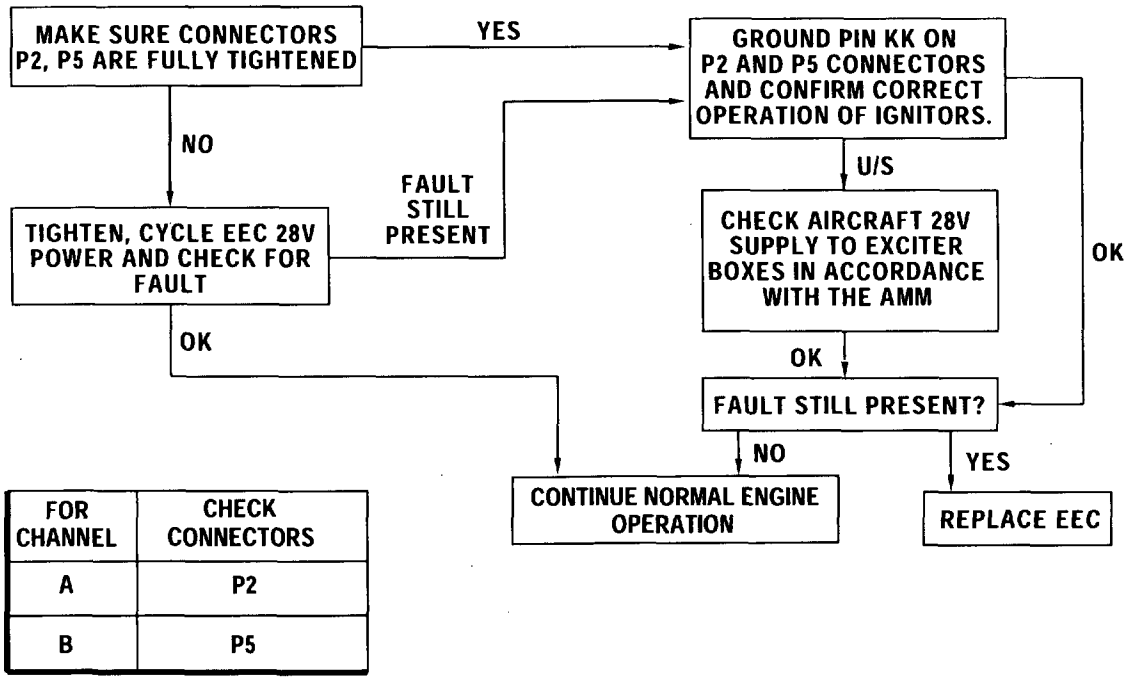
P&WC Proprietary Information. Subject to the restrictions on the title page.

MFD CODE	FAULT	FAULT LEVEL
5L	IGNITER DRIVE OPEN (EEC INTERNAL OPEN)	1
5M	IGNITER DRIVE SHORT (EEC INTERNAL SHORT OR EXTERNAL OPEN)	1

EFFECTS ON SYSTEM - 5L - Ⓓ NO IGNITER DRIVE OUTPUT TO AIRCRAFT IGNITER RELAY.
- Ⓓ NO IGNITER SEQUENCING.
- Ⓓ NO ENGINE LIGHT OR START UP TO IDLE.
- Ⓢ EEC CHANNEL SWITCHOVER.

5M - Ⓢ CONTINUOUS IGNITER DRIVE OUTPUT TO AIRCRAFT IGNITION RELAY WITH AIRCRAFT28V POWER ON.
- Ⓢ IGNITERS FIRE CONTINUOUSLY WHILE ENGINE RUNNING AND IGNITION IN AUTO MODE.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32887D

MFD Codes with LRU Prefix 5
Figure 105 (Sheet 9)

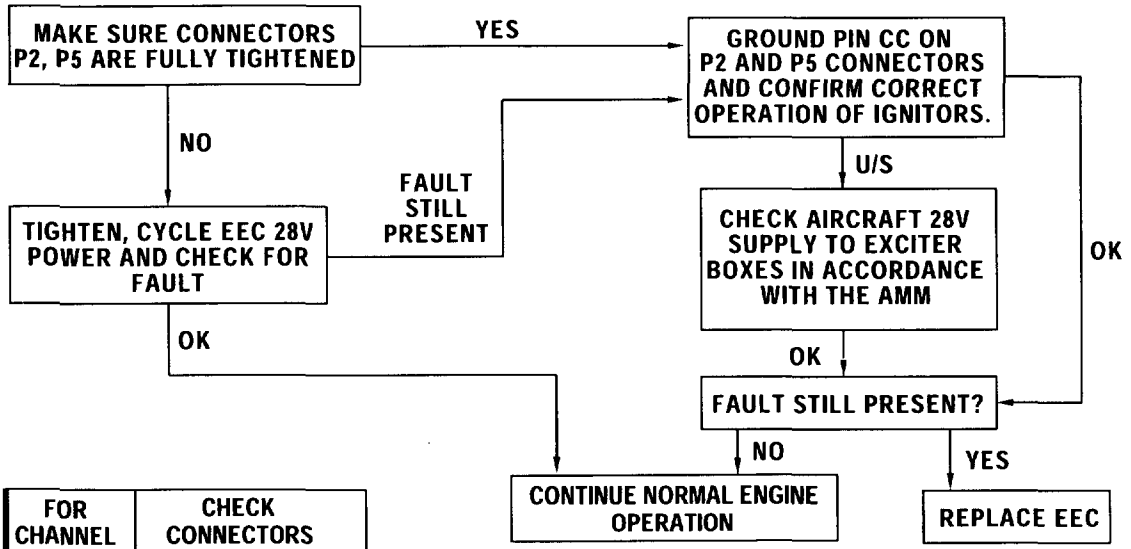
P&WC Proprietary Information. Subject to the restrictions on the title page.

MFD CODE	FAULT	FAULT LEVEL
5L	IGNITER DRIVE OPEN (EEC INTERNAL OPEN)	1
5M	IGNITER DRIVE SHORT (EEC INTERNAL SHORT OR EXTERNAL OPEN)	1

EFFECTS ON SYSTEM - 5L - Ⓓ NO IGNITER DRIVE OUTPUT TO AIRCRAFT IGNITER RELAY.
- Ⓓ NO IGNITER SEQUENCING.
- Ⓓ NO ENGINE LIGHT OR START UP TO IDLE.
- Ⓢ EEC CHANNEL SWITCHOVER.

5M - Ⓢ CONTINUOUS IGNITER DRIVE OUTPUT TO AIRCRAFT IGNITION RELAY WITH AIRCRAFT28V POWER ON.
- Ⓢ IGNITERS FIRE CONTINUOUSLY WHILE ENGINE RUNNING AND IGNITION IN AUTO MODE.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C63304

MFD Codes with LRU Prefix 5
Figure 105 (Sheet 10)

P&WC Proprietary Information. Subject to the restrictions on the title page.

FAULT ISOLATION - 3 (PRE-SB24434/POST-SB24514)

1. MFD Codes AA to WE

   A. List of Figures

      (1) Refer to FAULT ISOLATION - 1 for locations of connectors and LRUs.

      (2) Table 101 lists all figures contained in Fault Isolation - 3.

TABLE 101, List of Figures

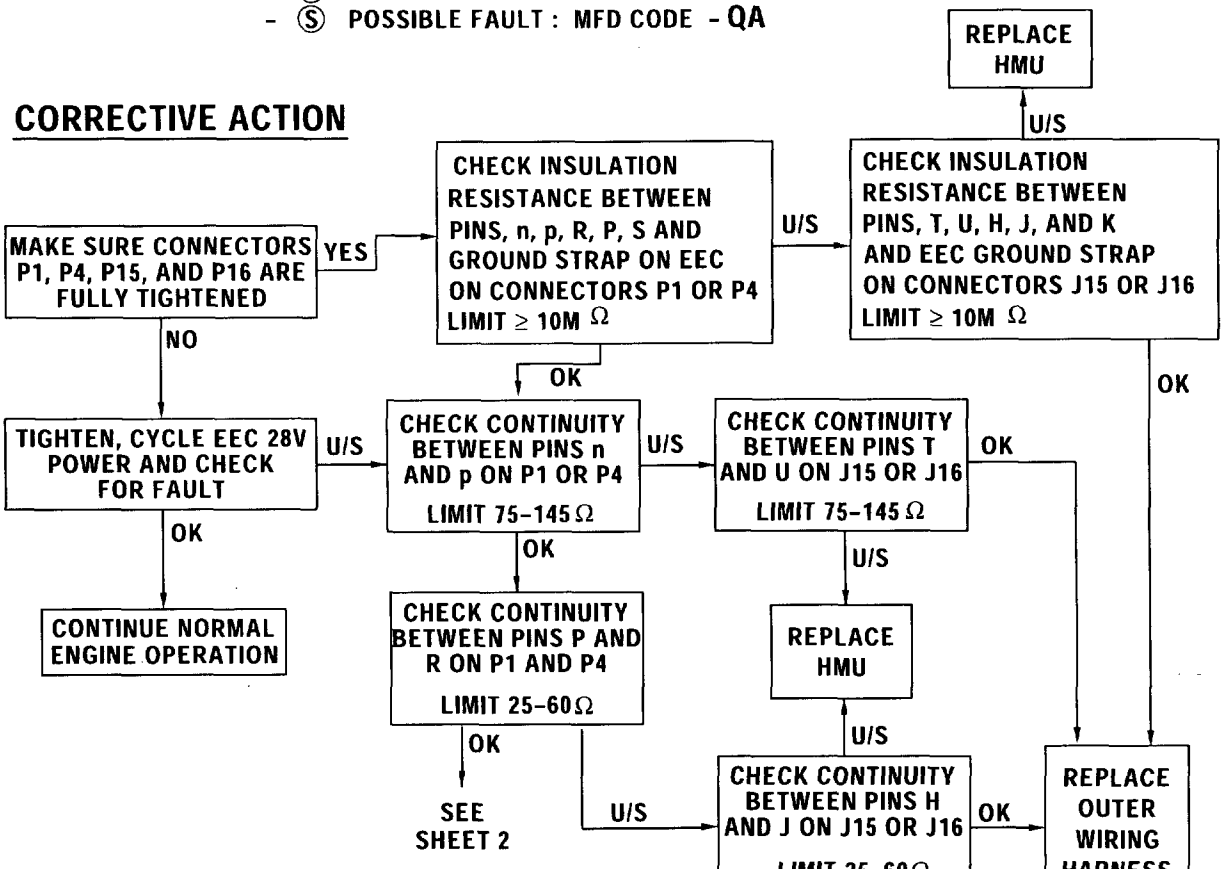
Figure Title	Figure No.
MFD Codes with LRU Prefix A	101
MFD Codes with LRU Prefix B	102
MFD Codes with LRU Prefix C	103
MFD Codes with LRU Prefix D	104
MFD Codes with LRU Prefix E	105
MFD Codes with LRU Prefix F	106
MFD Codes with LRU Prefix G	107
MFD Codes with LRU Prefix H	108
MFD Codes with LRU Prefix J	109
MFD Codes with LRU Prefix K	110
MFD Codes with LRU Prefix L	111
MFD Codes with LRU Prefix M	112
MFD Codes with LRU Prefix N	113
MFD Codes with LRU Prefix P	114
MFD Codes with LRU Prefix Q	115
MFD Codes with LRU Prefix R	116
MFD Codes with LRU Prefix S	117
MFD Codes with LRU Prefix T	118
MFD Codes with LRU Prefix U	119
MFD Codes with LRU Prefix V	120
MFD Codes with LRU Prefix W	121

P&WC Proprietary Information. Subject to the restrictions on the title page.

MFD CODE	FAULT	FAULT LEVEL
AA	Wf INPUT INTERFACE	3

EFFECTS ON SYSTEM - Ⓓ LOSS OF HMU Wf METERING VALVE POSITIONAL CONTROL.
- Ⓓ INDICATED HMU METERING VALVE POSITION DEFAULTS TO 10 MILLIMETERS.
- Ⓓ SHUT DOWN.
- Ⓓ NO ENGINE START CAPABILITY.
- Ⓢ EEC CHANNEL SWITCHOVER.
- Ⓢ POSSIBLE FAULT : MFD CODE - QA

CORRECTIVE ACTION

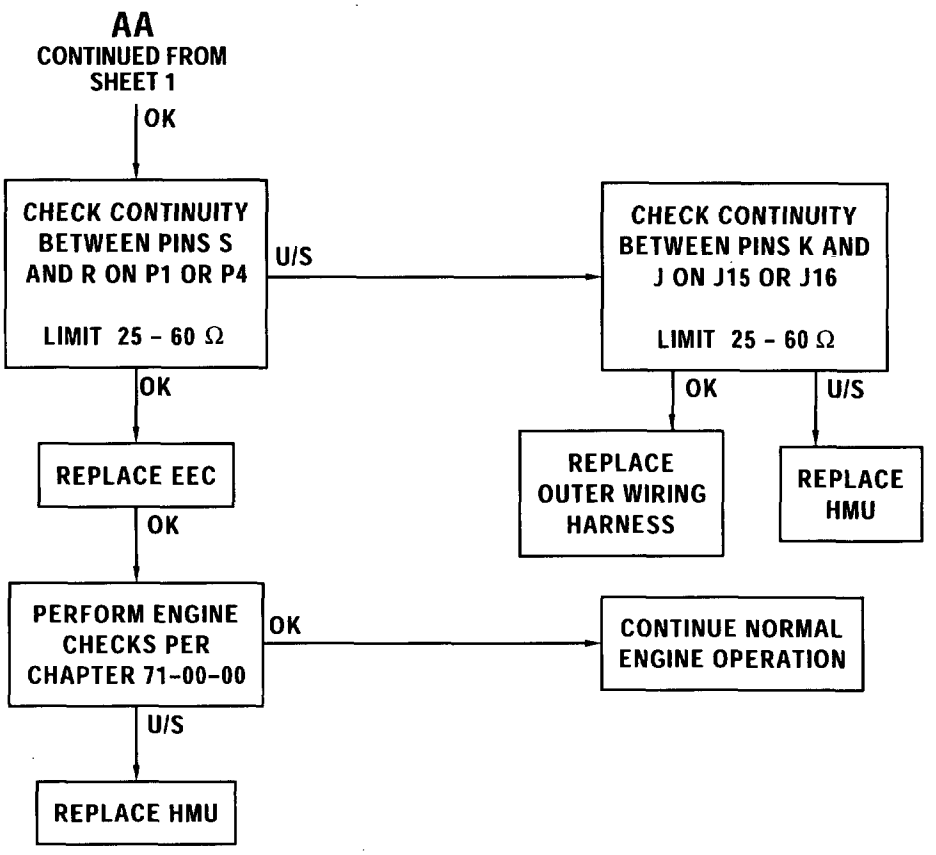

MAKE SURE CONNECTORS P1, P4, P15, AND P16 ARE FULLY TIGHTENED
YES
NO
CHECK INSULATION RESISTANCE BETWEEN PINS, n, p, R, P, S AND GROUND STRAP ON EEC ON CONNECTORS P1 OR P4 LIMIT ≥ 10M Ω
U/S
OK
CHECK INSULATION RESISTANCE BETWEEN PINS, T, U, H, J, AND K AND EEC GROUND STRAP ON CONNECTORS J15 OR J16 LIMIT ≥ 10M Ω
U/S
REPLACE HMU
U/S
OK
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY BETWEEN PINS n AND p ON P1 OR P4 LIMIT 75-145 Ω
U/S
OK
CHECK CONTINUITY BETWEEN PINS T AND U ON J15 OR J16 LIMIT 75-145 Ω
OK
U/S
REPLACE HMU
U/S
CHECK CONTINUITY BETWEEN PINS P AND R ON P1 AND P4 LIMIT 25-60Ω
OK
SEE SHEET 2
U/S
CHECK CONTINUITY BETWEEN PINS H AND J ON J15 OR J16 LIMIT 25-60Ω
OK
REPLACE OUTER WIRING HARNESS

FOR CHANNEL	CHECK CONNECTORS
A	P1, J15
B	P4, J16

NOTE: Ⓢ = SINGLE CHANNEL FAULT
Ⓓ = DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32889E

MFD Codes with LRU Prefix A
Figure 101 (Sheet 1 of 9)



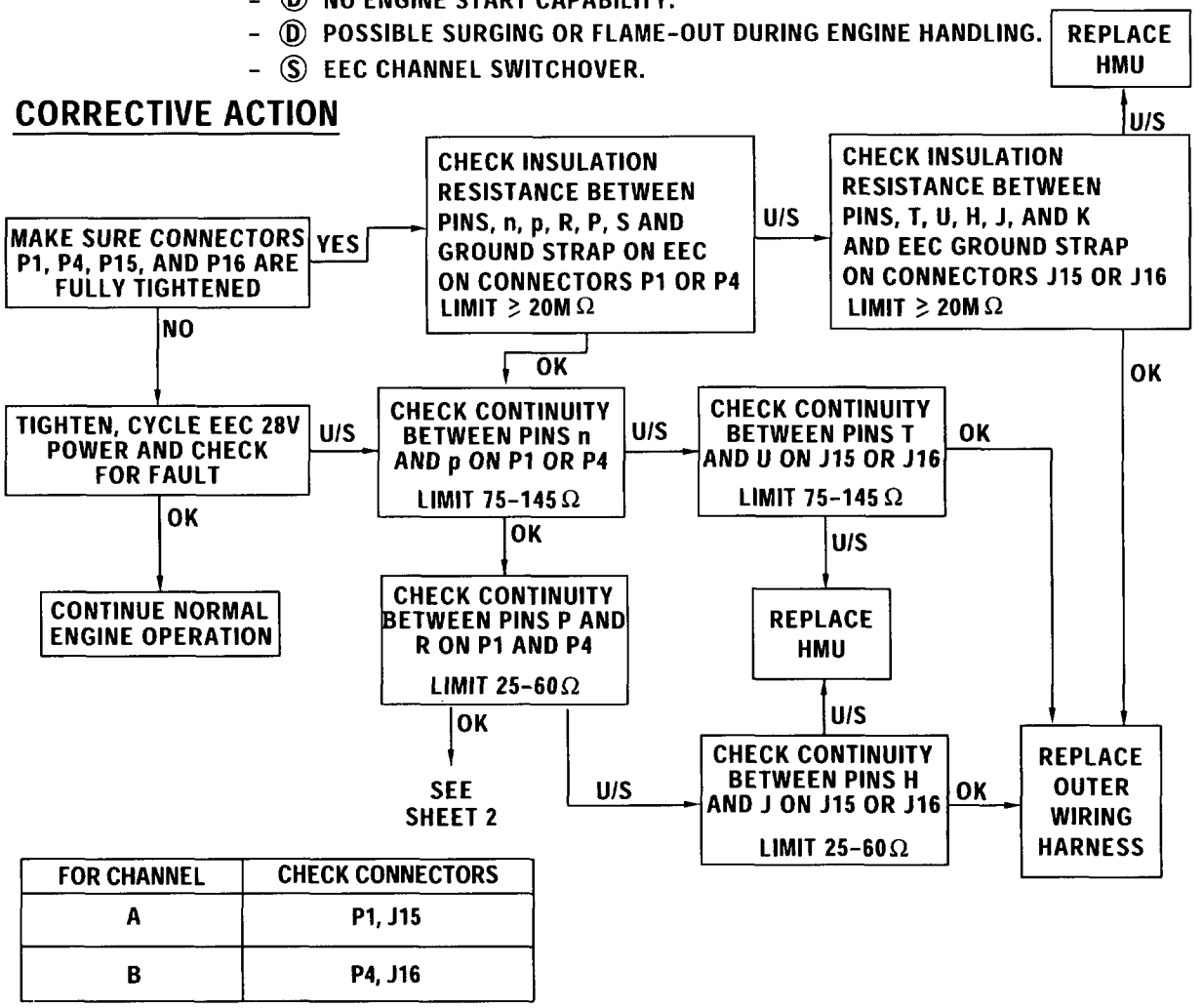
Pre-SB24434/Post-SB24514 C33819

MFD Codes with LRU Prefix A
Figure 101 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
AB	Wf INPUT RATE OR RANGE	3

EFFECTS ON SYSTEM: - Ⓓ EEC LOSS OF CONTROL; Wf METERING VALVE POSITION EXCEEDS NORMAL OPERATING LIMITS.
- Ⓓ POSSIBLE SLUGGISH ENGINE HANDLING.
- Ⓓ NO ENGINE START CAPABILITY.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION

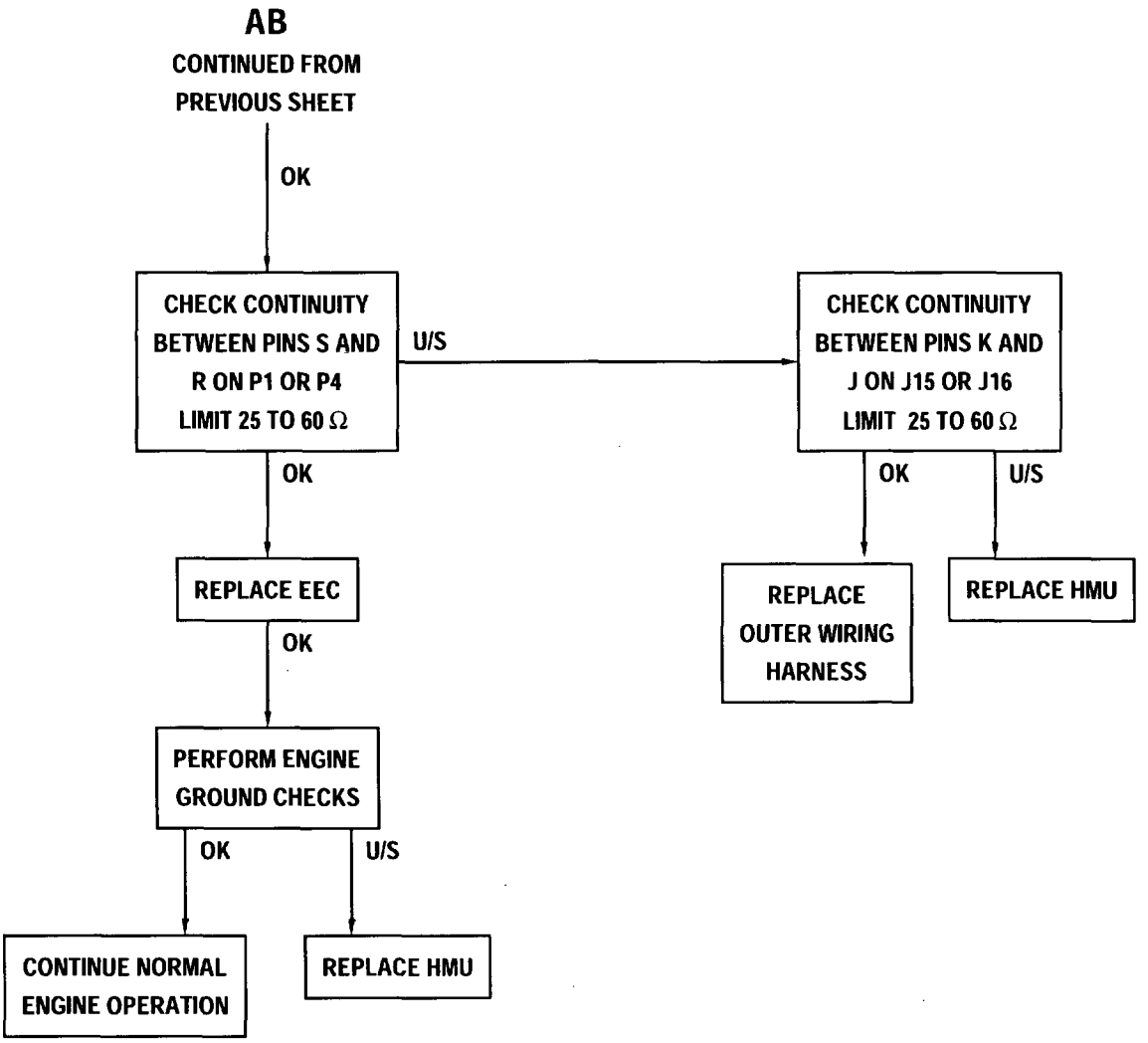

MAKE SURE CONNECTORS P1, P4, P15, AND P16 ARE FULLY TIGHTENED
YES
NO
CHECK INSULATION RESISTANCE BETWEEN PINS, n, p, R, P, S AND GROUND STRAP ON EEC ON CONNECTORS P1 OR P4 LIMIT ≥ 20MΩ
U/S
CHECK INSULATION RESISTANCE BETWEEN PINS, T, U, H, J, AND K AND EEC GROUND STRAP ON CONNECTORS J15 OR J16 LIMIT ≥ 20MΩ
REPLACE HMU
U/S
OK
OK
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CHECK CONTINUITY BETWEEN PINS n AND p ON P1 OR P4 LIMIT 75-145Ω
U/S
CHECK CONTINUITY BETWEEN PINS T AND U ON J15 OR J16 LIMIT 75-145Ω
OK
OK
U/S
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY BETWEEN PINS P AND R ON P1 AND P4 LIMIT 25-60Ω
REPLACE HMU
U/S
OK
SEE SHEET 2
U/S
CHECK CONTINUITY BETWEEN PINS H AND J ON J15 OR J16 LIMIT 25-60Ω
OK
REPLACE OUTER WIRING HARNESS

FOR CHANNEL	CHECK CONNECTORS
A	P1, J15
B	P4, J16

NOTE: Ⓢ = SINGLE CHANNEL FAULT
Ⓓ = DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32890D

MFD Codes with LRU Prefix A
Figure 101 (Sheet 3)



Pre-SB24434/Post-SB24514 C33716

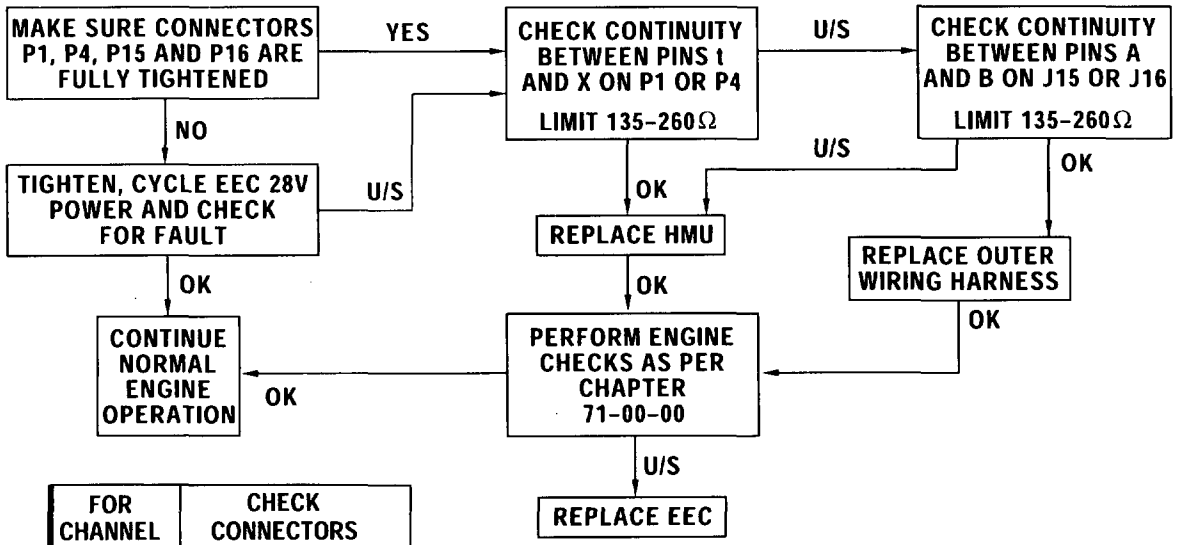
MFD Codes with LRU Prefix A
Figure 101 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
AC	Wf DRIVER	3
AD	Wf CONTROL LOOP (TRACK CHECK)	3

EFFECTS ON SYSTEM - **AC**
- Ⓓ LOSS OF EEC OUTPUT DRIVER TO HMU Wf TORQUEMOTOR.
- Ⓓ EEC LOSS OF CONTROL; Wf METERING VALVE DOES NOT RESPOND TO TLA POSITION.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓓ POSSIBLE ENGINE SHUTDOWN.
- Ⓢ EEC CHANNEL SWITCHOVER.

AD
- Ⓓ LOSS OF HMU Wf TORQUEMOTOR, SERVO, OR METERING VALVE CONTROL.
- Ⓓ EEC LOSS OF METERING VALVE CONTROL; Wf METERING VALVE DOES NOT TRACK.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓓ POSSIBLE ENGINE SHUTDOWN.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P1, J15
B	P4, J16

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

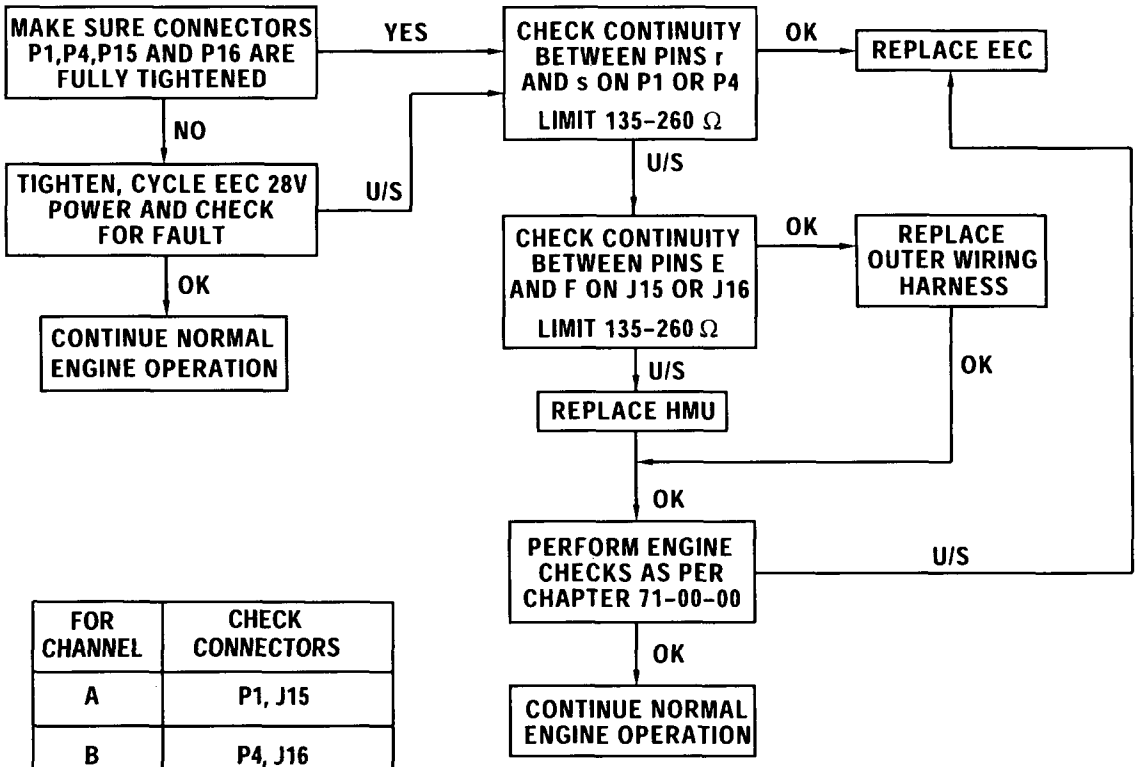
Pre-SB24434/Post-SB24514 C32891C

MFD Codes with LRU Prefix A
Figure 101 (Sheet 5)

MFD CODE	FAULT	FAULT LEVEL
AE	IGV DRIVER	3

EFFECTS ON SYSTEM
- Ⓓ LOSS OF HMU IGV TORQUEMOTOR SERVO.
- Ⓓ EEC LOSS OF IGV CONTROL; IGV DOES NOT TRACK.
- Ⓓ POSSIBLE SLUGGISH ENGINE HANDLING.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓓ POSSIBLE STARTING PROBLEMS.
- Ⓓ POSSIBLE ENGINE SHUTDOWN.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P1, J15
B	P4, J16

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

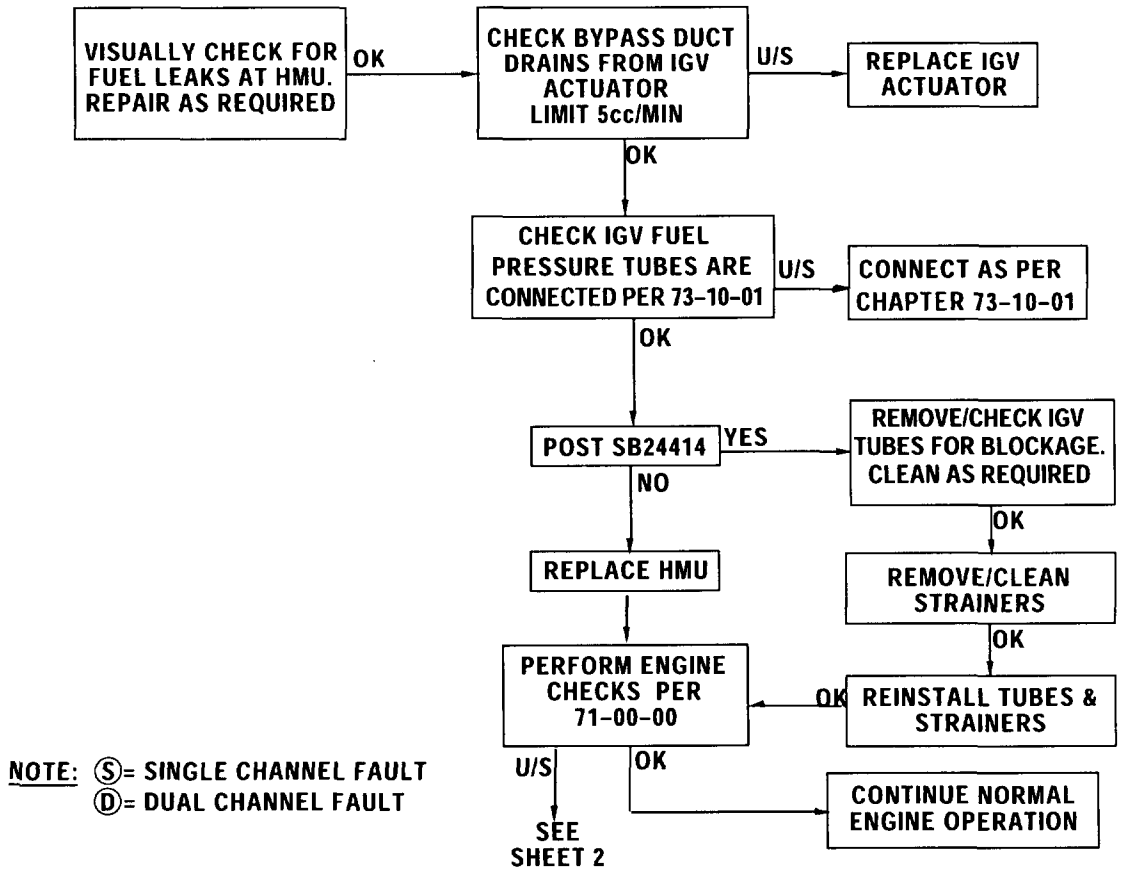
Pre-SB24434/Post-SB24514 C32893C

MFD Codes with LRU Prefix A
Figure 101 (Sheet 6)

MFD CODE	FAULT	FAULT LEVEL
AF	IGV CONTROL LOOP (LOOSE TRACK CHECK)	3
AH	IGV TRACK CHECK - STEADY STATE	3

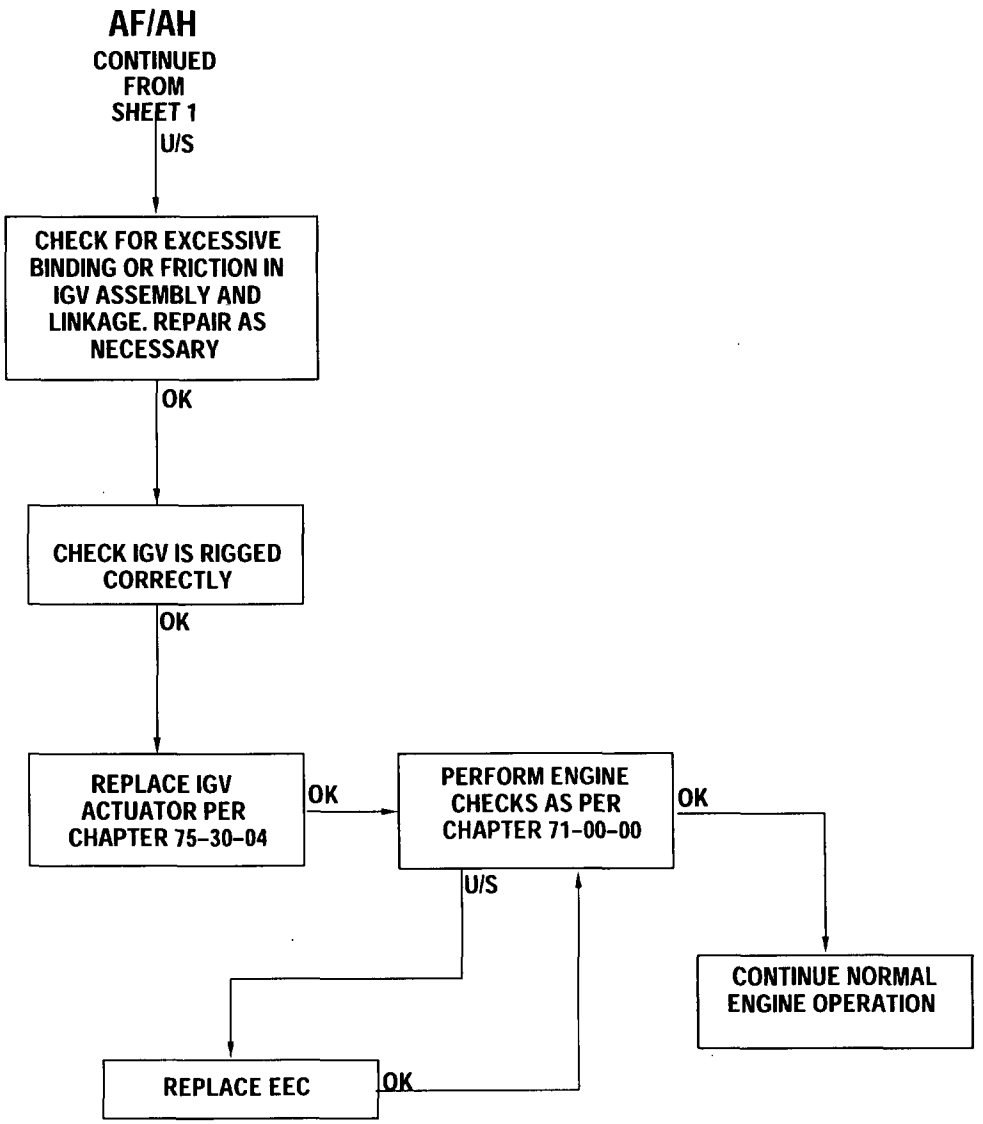
EFFECTS ON SYSTEM
- Ⓓ ABORTS ENGINE START WHEN ON GROUND.
- Ⓓ IGV ACTUATOR DOES NOT TRACK EEC COMMANDED POSITION.
- Ⓓ EEC LOSS OF IGV CONTROL; IGV DOES NOT TRACK.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓓ POSSIBLE ENGINE SHUTDOWN.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION



Pre-SB24434/Post-SB24514 C32894G

MFD Codes with LRU Prefix A
Figure 101 (Sheet 7)



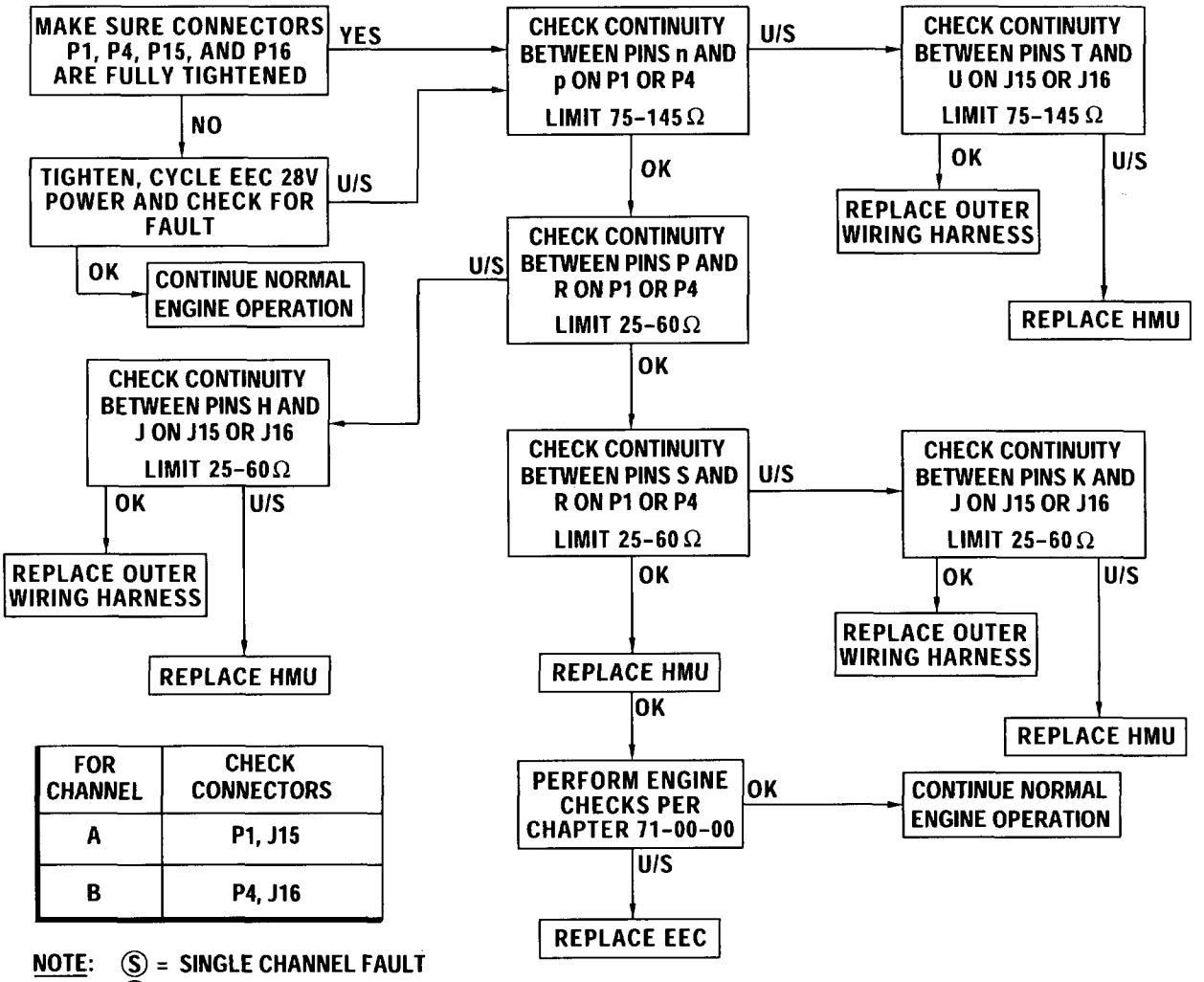
Pre-SB24434/Post-SB24514 C63327

MFD Codes with LRU Prefix A
Figure 101 (Sheet 8)

MFD CODE	FAULT	FAULT LEVEL
AG	METERING VALVE NOT CLOSED	1

EFFECTS ON SYSTEM: - Ⓓ HMU Wf METERING VALVE POSITION NOT IN CUT-OFF WHEN TLA IS IN CUT-OFF DETENT AND N2 IS LESS THAN 5%
- Ⓓ HMU METERING VALVE CANNOT SHUT-OFF FUEL
- Ⓢ EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P1, J15
B	P4, J16

NOTE: Ⓢ = SINGLE CHANNEL FAULT
Ⓓ = DUAL CHANNEL FAULT

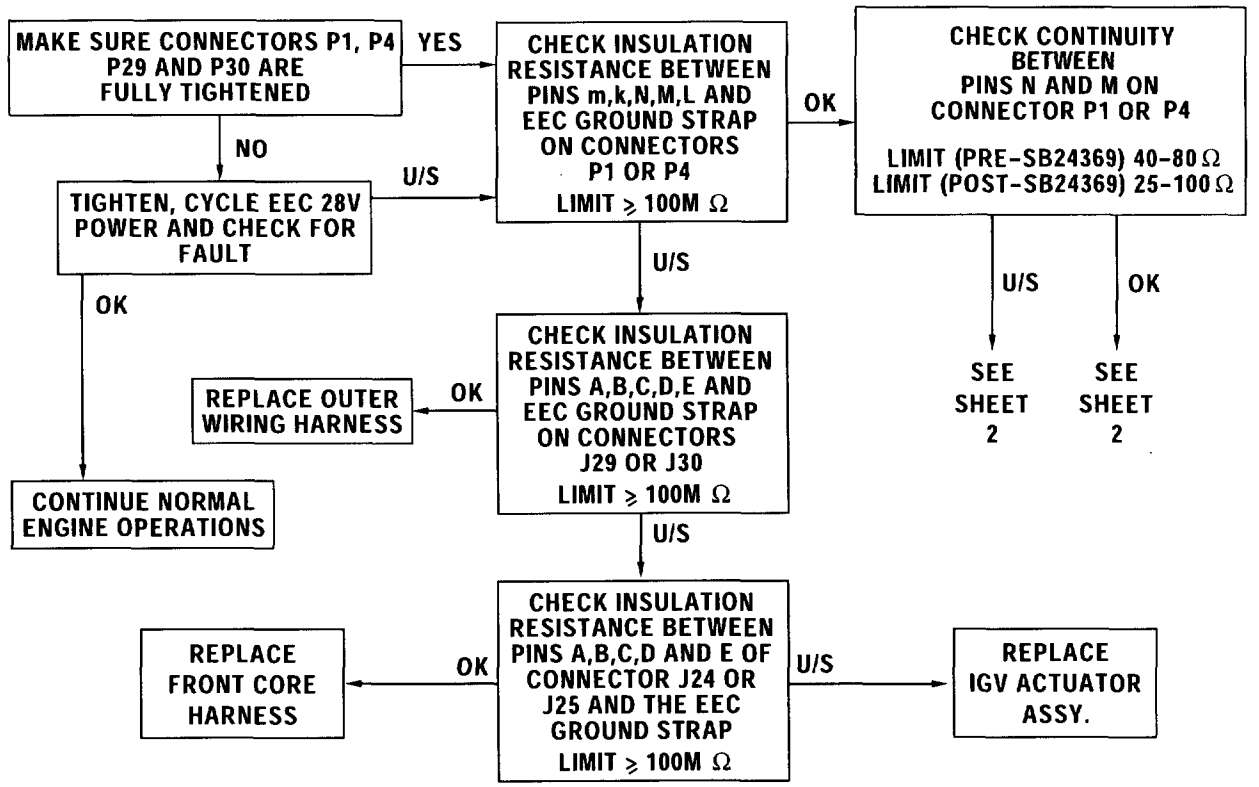
Pre-SB24434/Post-SB24514 C32895D

MFD Codes with LRU Prefix A
Figure 101 (Sheet 9)

MFD CODE	FAULT	FAULT LEVEL
BA	IGV INPUT INTERFACE	3

EFFECTS ON SYSTEM
- Ⓓ LOSS OF IGV ACTUATOR POSITION.
- Ⓓ IGV DEFAULTS TO FULLY OPEN POSITION.
- Ⓓ POSSIBLE ENGINE HANDLING DIFFICULTIES.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓓ POSSIBLE ENGINE SHUTDOWN.
- Ⓢ EEC CHANNEL SWITCHOVER.

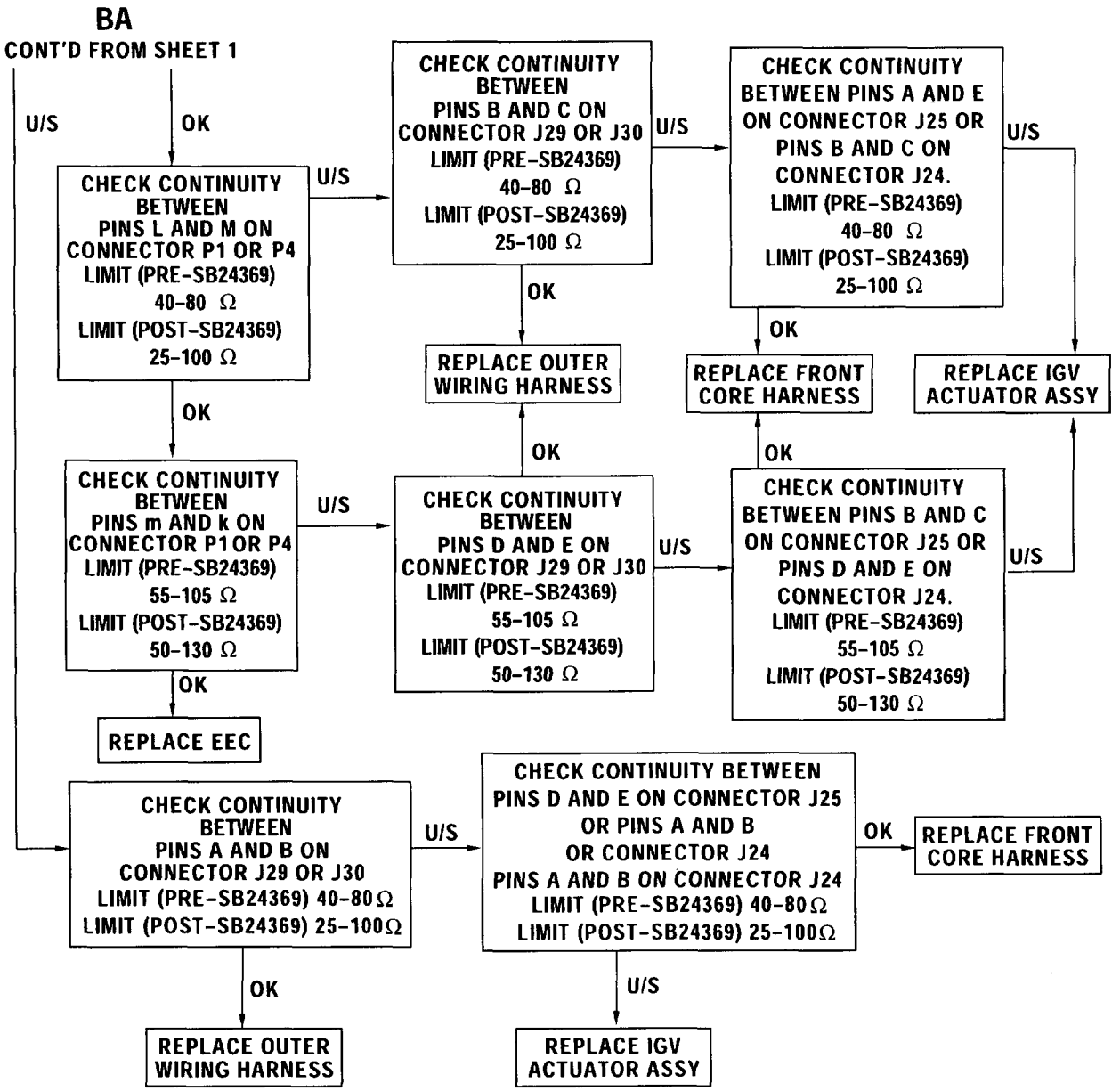
CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4 P29 AND P30 ARE FULLY TIGHTENED
YES
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATIONS
CHECK INSULATION RESISTANCE BETWEEN PINS m,k,N,M,L AND EEC GROUND STRAP ON CONNECTORS P1 OR P4
LIMIT ≥ 100M Ω
U/S
OK
CHECK CONTINUITY BETWEEN PINS N AND M ON CONNECTOR P1 OR P4
LIMIT (PRE-SB24369) 40-80 Ω
LIMIT (POST-SB24369) 25-100 Ω
U/S
OK
SEE SHEET 2
SEE SHEET 2
CHECK INSULATION RESISTANCE BETWEEN PINS A,B,C,D,E AND EEC GROUND STRAP ON CONNECTORS J29 OR J30
LIMIT ≥ 100M Ω
OK
REPLACE OUTER WIRING HARNESS
U/S
CHECK INSULATION RESISTANCE BETWEEN PINS A,B,C,D AND E OF CONNECTOR J24 OR J25 AND THE EEC GROUND STRAP
LIMIT ≥ 100M Ω
OK
REPLACE FRONT CORE HARNESS
U/S
REPLACE IGV ACTUATOR ASSY.

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32896G

MFD Codes with LRU Prefix B
Figure 102 (Sheet 1 of 4)


BA
CONT'D FROM SHEET 1
U/S
OK
CHECK CONTINUITY BETWEEN PINS L AND M ON CONNECTOR P1 OR P4
LIMIT (PRE-SB24369) 40-80 Ω
LIMIT (POST-SB24369) 25-100 Ω
U/S
CHECK CONTINUITY BETWEEN PINS B AND C ON CONNECTOR J29 OR J30
LIMIT (PRE-SB24369) 40-80 Ω
LIMIT (POST-SB24369) 25-100 Ω
U/S
CHECK CONTINUITY BETWEEN PINS A AND E ON CONNECTOR J25 OR PINS B AND C ON CONNECTOR J24.
LIMIT (PRE-SB24369) 40-80 Ω
LIMIT (POST-SB24369) 25-100 Ω
U/S
OK
REPLACE OUTER WIRING HARNESS
OK
REPLACE FRONT CORE HARNESS
OK
REPLACE IGV ACTUATOR ASSY
CHECK CONTINUITY BETWEEN PINS m AND k ON CONNECTOR P1 OR P4
LIMIT (PRE-SB24369) 55-105 Ω
LIMIT (POST-SB24369) 50-130 Ω
U/S
CHECK CONTINUITY BETWEEN PINS D AND E ON CONNECTOR J29 OR J30
LIMIT (PRE-SB24369) 55-105 Ω
LIMIT (POST-SB24369) 50-130 Ω
U/S
CHECK CONTINUITY BETWEEN PINS B AND C ON CONNECTOR J25 OR PINS D AND E ON CONNECTOR J24.
LIMIT (PRE-SB24369) 55-105 Ω
LIMIT (POST-SB24369) 50-130 Ω
U/S
OK
REPLACE EEC
CHECK CONTINUITY BETWEEN PINS A AND B ON CONNECTOR J29 OR J30
LIMIT (PRE-SB24369) 40-80Ω
LIMIT (POST-SB24369) 25-100Ω
U/S
CHECK CONTINUITY BETWEEN PINS D AND E ON CONNECTOR J25 OR PINS A AND B OR CONNECTOR J24
PINS A AND B ON CONNECTOR J24
LIMIT (PRE-SB24369) 40-80Ω
LIMIT (POST-SB24369) 25-100Ω
OK
REPLACE FRONT CORE HARNESS
OK
REPLACE OUTER WIRING HARNESS
U/S
REPLACE IGV ACTUATOR ASSY

FOR CHANNEL	CHECK CONNECTORS
A	P1, J25, P29, J29
B	P4, J24, P30, J30

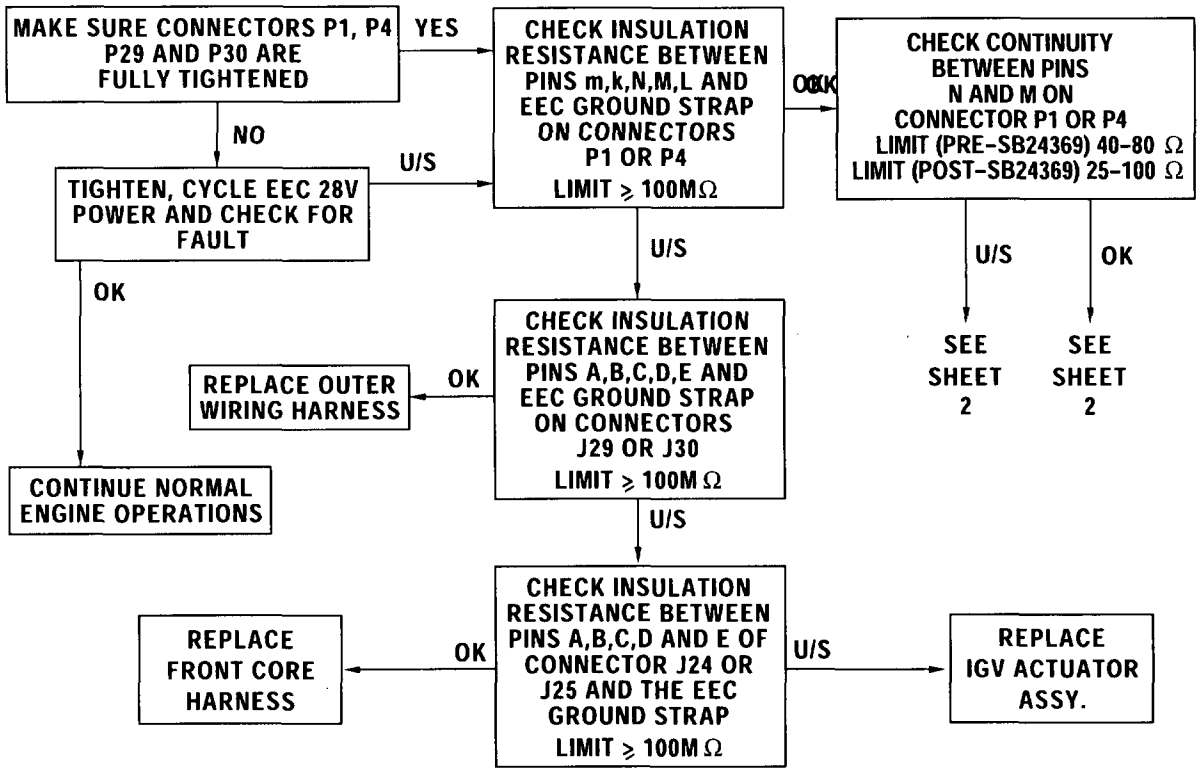
Pre-SB24434/Post-SB24514 C32992E

MFD Codes with LRU Prefix B
Figure 102 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
BB	IGV RATE OR RANGE	3

EFFECTS ON SYSTEM - Ⓓ LOSS OF IGV ACTUATOR POSITION.
- Ⓓ IGV DEFAULTS TO FULLY OPEN POSITION.
- Ⓓ POSSIBLE ENGINE HANDLING DIFFICULTIES.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓓ POSSIBLE ENGINE SHUTDOWN.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION

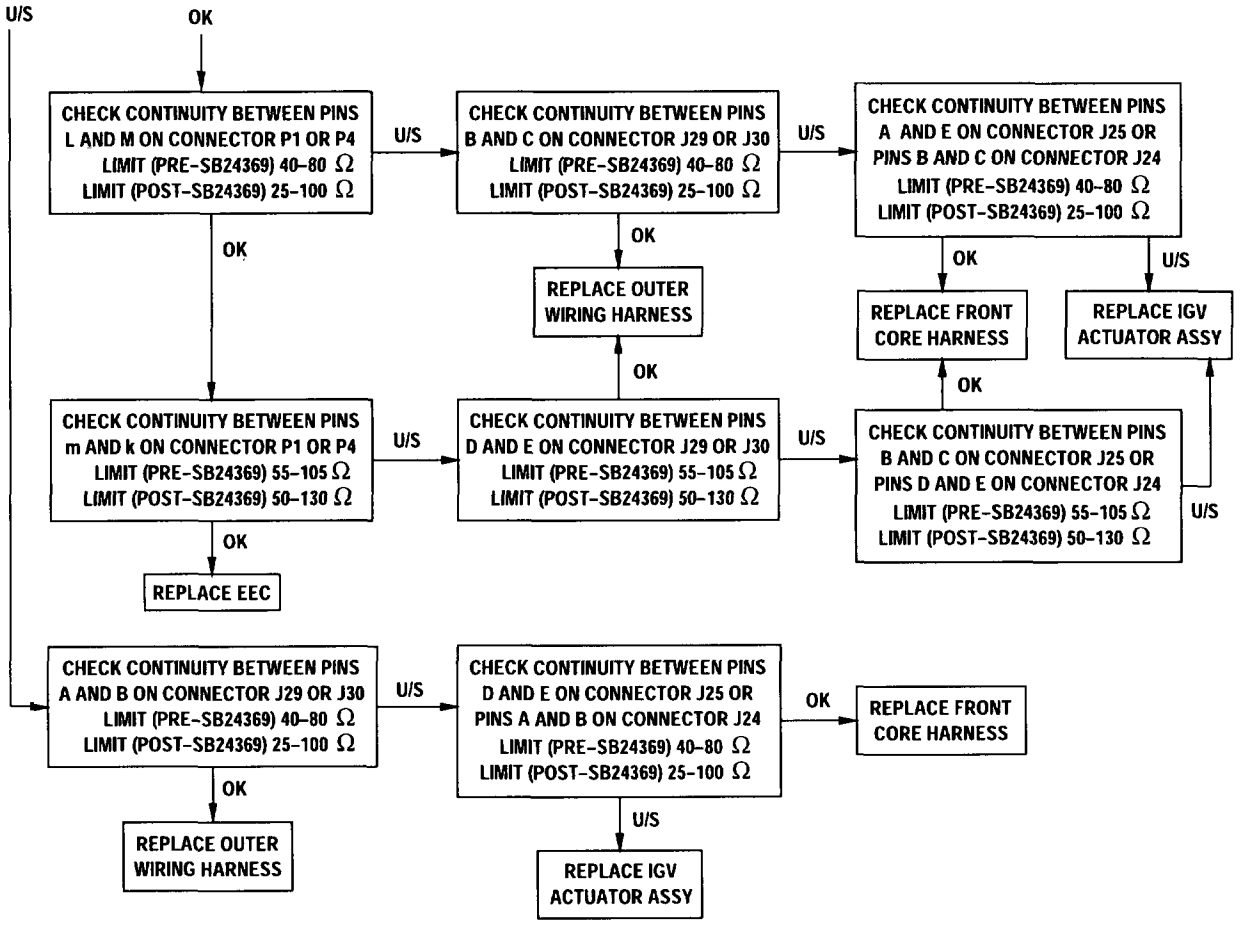

MAKE SURE CONNECTORS P1, P4 P29 AND P30 ARE FULLY TIGHTENED
YES
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATIONS
CHECK INSULATION RESISTANCE BETWEEN PINS m,k,N,M,L AND EEC GROUND STRAP ON CONNECTORS P1 OR P4
LIMIT ≥ 100MΩ
OK
CHECK CONTINUITY BETWEEN PINS N AND M ON CONNECTOR P1 OR P4
LIMIT (PRE-SB24369) 40-80 Ω
LIMIT (POST-SB24369) 25-100 Ω
U/S
OK
SEE SHEET 2
SEE SHEET 2
U/S
CHECK INSULATION RESISTANCE BETWEEN PINS A,B,C,D,E AND EEC GROUND STRAP ON CONNECTORS J29 OR J30
LIMIT ≥ 100MΩ
OK
REPLACE OUTER WIRING HARNESS
U/S
CHECK INSULATION RESISTANCE BETWEEN PINS A,B,C,D AND E OF CONNECTOR J24 OR J25 AND THE EEC GROUND STRAP
LIMIT ≥ 100MΩ
OK
REPLACE FRONT CORE HARNESS
U/S
REPLACE IGV ACTUATOR ASSY.

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C61042B

MFD Codes with LRU Prefix B
Figure 102 (Sheet 3)

BB CONTINUED FROM SHEET 1


U/S
OK
CHECK CONTINUITY BETWEEN PINS L AND M ON CONNECTOR P1 OR P4
LIMIT (PRE-SB24369) 40-80 Ω
LIMIT (POST-SB24369) 25-100 Ω
U/S
CHECK CONTINUITY BETWEEN PINS B AND C ON CONNECTOR J29 OR J30
LIMIT (PRE-SB24369) 40-80 Ω
LIMIT (POST-SB24369) 25-100 Ω
U/S
CHECK CONTINUITY BETWEEN PINS A AND E ON CONNECTOR J25 OR PINS B AND C ON CONNECTOR J24
LIMIT (PRE-SB24369) 40-80 Ω
LIMIT (POST-SB24369) 25-100 Ω
OK
U/S
OK
REPLACE OUTER WIRING HARNESS
REPLACE FRONT CORE HARNESS
REPLACE IGV ACTUATOR ASSY
OK
OK
CHECK CONTINUITY BETWEEN PINS m AND k ON CONNECTOR P1 OR P4
LIMIT (PRE-SB24369) 55-105 Ω
LIMIT (POST-SB24369) 50-130 Ω
U/S
CHECK CONTINUITY BETWEEN PINS D AND E ON CONNECTOR J29 OR J30
LIMIT (PRE-SB24369) 55-105 Ω
LIMIT (POST-SB24369) 50-130 Ω
U/S
CHECK CONTINUITY BETWEEN PINS B AND C ON CONNECTOR J25 OR PINS D AND E ON CONNECTOR J24
LIMIT (PRE-SB24369) 55-105 Ω
LIMIT (POST-SB24369) 50-130 Ω
U/S
OK
REPLACE EEC
CHECK CONTINUITY BETWEEN PINS A AND B ON CONNECTOR J29 OR J30
LIMIT (PRE-SB24369) 40-80 Ω
LIMIT (POST-SB24369) 25-100 Ω
U/S
CHECK CONTINUITY BETWEEN PINS D AND E ON CONNECTOR J25 OR PINS A AND B ON CONNECTOR J24
LIMIT (PRE-SB24369) 40-80 Ω
LIMIT (POST-SB24369) 25-100 Ω
OK
REPLACE FRONT CORE HARNESS
OK
U/S
REPLACE OUTER WIRING HARNESS
REPLACE IGV ACTUATOR ASSY

FOR CHANNEL	CHECK CONNECTORS
A	P1, J25, P29, J29
B	P4, J24, P30, J30

Pre-SB24434/Post-SB24514 C61043A

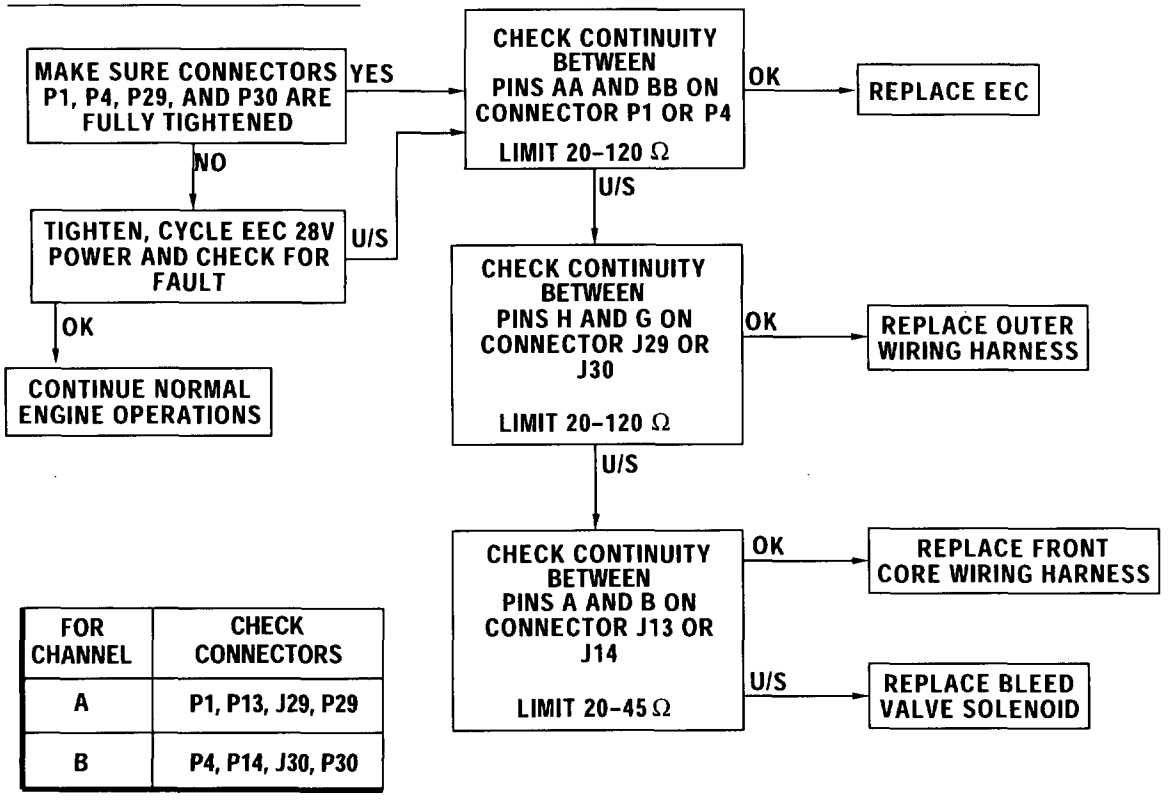
MFD Codes with LRU Prefix B
Figure 102 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
CA	BOV DRIVE EXTERNAL OPEN CIRCUIT	2

EFFECTS ON SYSTEM
- Ⓓ LOSS OF CONTROL TO BLEED VALVE SOLENOID.
- Ⓓ BLEED VALVE REMAINS OPEN.
- Ⓓ POSSIBLE LOSS OF EXPECTED ENGINE THRUST.
- Ⓓ HIGH T45 OPERATING TEMPERATURE.
- Ⓢ EEC CHANNEL SWITCHOVER.
- Ⓓ POSSIBLE OVERTEMPERATURE OF ACCESSORIES.

CHECK
- BOV SOLENOIDS
- IGV ACTUATOR
- ANTI-ICE SOLENOID
- FRONT CORE HARNESS
- #3 BRG SCAVENGE OIL PIPE FOR LEAKAGE

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P29, AND P30 ARE FULLY TIGHTENED
YES
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATIONS
CHECK CONTINUITY BETWEEN PINS AA AND BB ON CONNECTOR P1 OR P4
LIMIT 20–120 Ω
OK
REPLACE EEC
U/S
CHECK CONTINUITY BETWEEN PINS H AND G ON CONNECTOR J29 OR J30
LIMIT 20–120 Ω
OK
REPLACE OUTER WIRING HARNESS
U/S
CHECK CONTINUITY BETWEEN PINS A AND B ON CONNECTOR J13 OR J14
LIMIT 20–45 Ω
OK
REPLACE FRONT CORE WIRING HARNESS
U/S
REPLACE BLEED VALVE SOLENOID

FOR CHANNEL	CHECK CONNECTORS
A	P1, P13, J29, P29
B	P4, P14, J30, P30

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32898E

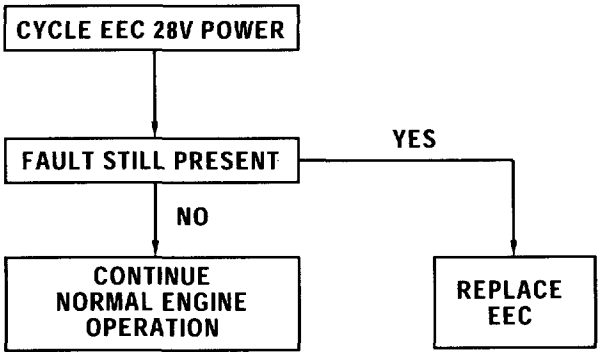
MFD Codes with LRU Prefix C
Figure 103 (Sheet 1 of 3)

MFD CODE	FAULT	FAULT LEVEL
CB	BOV DRIVE INTERNAL OPEN CIRCUIT	2
CC	BOV DRIVE INTERNAL SHORT CIRCUIT	2

EFFECTS ON SYSTEM - **CB** - Ⓓ LOSS OF EEC BLEED VALVE SOLENOID OUTPUT DRIVER.
- Ⓓ BLEED VALVE REMAINS OPEN.
- Ⓓ POSSIBLE LOSS OF EXPECTED ENGINE THRUST.
- Ⓓ HIGH T45 OPERATING TEMPERATURE.
- Ⓢ EEC CHANNEL SWITCHOVER.

CC - Ⓓ LOSS OF EEC BLEED VALVE SOLENOID OUTPUT DRIVER.
- Ⓓ BLEED VALVE REMAINS CLOSED.
- Ⓓ POSSIBLE ENGINE SURGING DURING ENGINE HANDLING.
- Ⓓ POSSIBLE ENGINE HUNG DURING START.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION



NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32899B

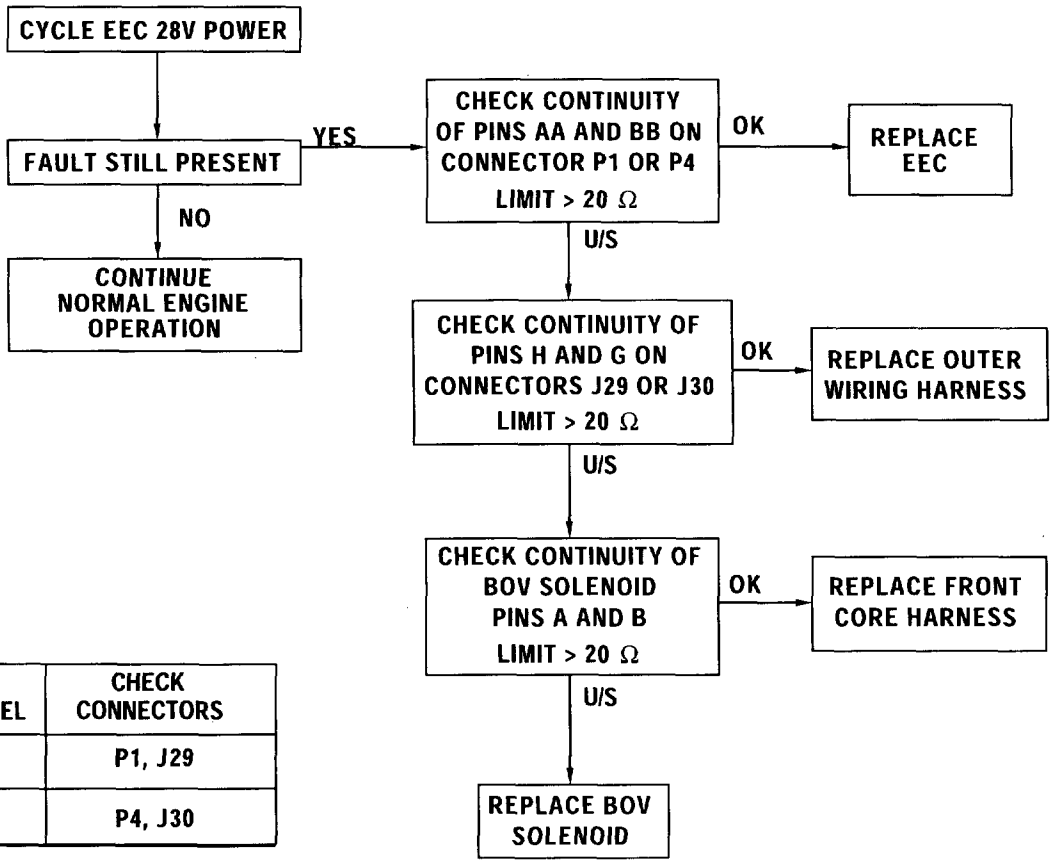
MFD Codes with LRU Prefix C
Figure 103 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
CD (POST-SB24274)	BOV BITE FAULT	2 *

EFFECTS ON SYSTEM - Ⓓ POSSIBLE LOSS OF EXPECTED ENGINE THRUST
- Ⓓ HIGH T45 OPERATING TEMPERATURE
- Ⓢ EEC CHANNEL SWITCHOVER
- Ⓓ EEC OUTPUT DRIVER MALFUNCTION
  LOSS OF BOV CONTROL
- Ⓓ OVERTEMPERATURE OF ACCESSORIES

CHECK - BOV SOLENOID
- IGV ACTUATOR
- ANTI-ICE SOLENOID
- FRONT CORE HARNESS

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P1, J29
B	P4, J30

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C33719B

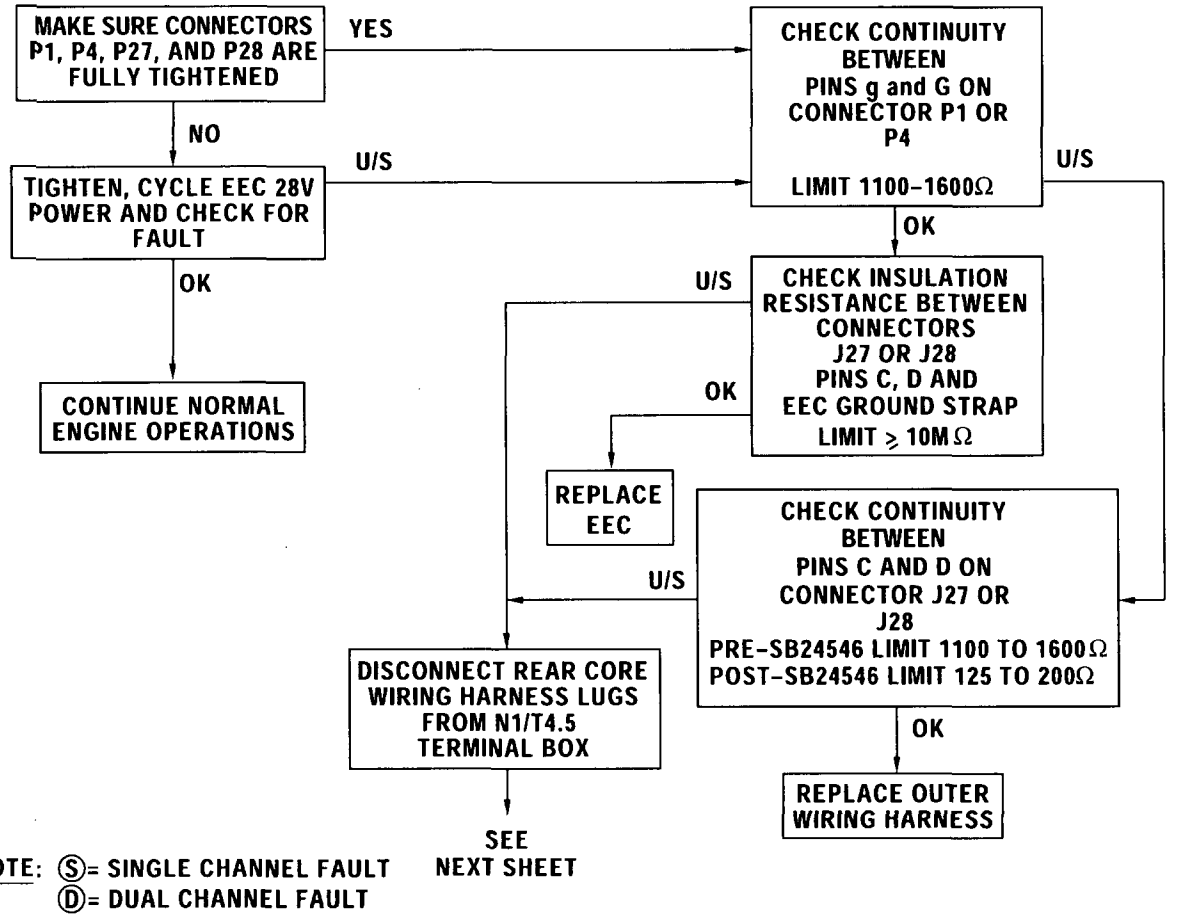
MFD Codes with LRU Prefix C
Figure 103 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
DA	N1 INPUT INTERFACE	2
DB	N1 RATE OR RANGE	2

EFFECTS ON SYSTEM - Ⓓ EEC CONTROL DEFAULTS TO N1 BACK-UP AS A FUNCTION OF N2.
- Ⓓ ATTCS DISARMED
- Ⓓ N1 POWER SETTING BASED ON N2.
- Ⓓ LOSS OF N1 SOFTWARE OVERSPEED PROTECTION.
- Ⓓ POSSIBLE CHANGE IN ENGINE THRUST.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION

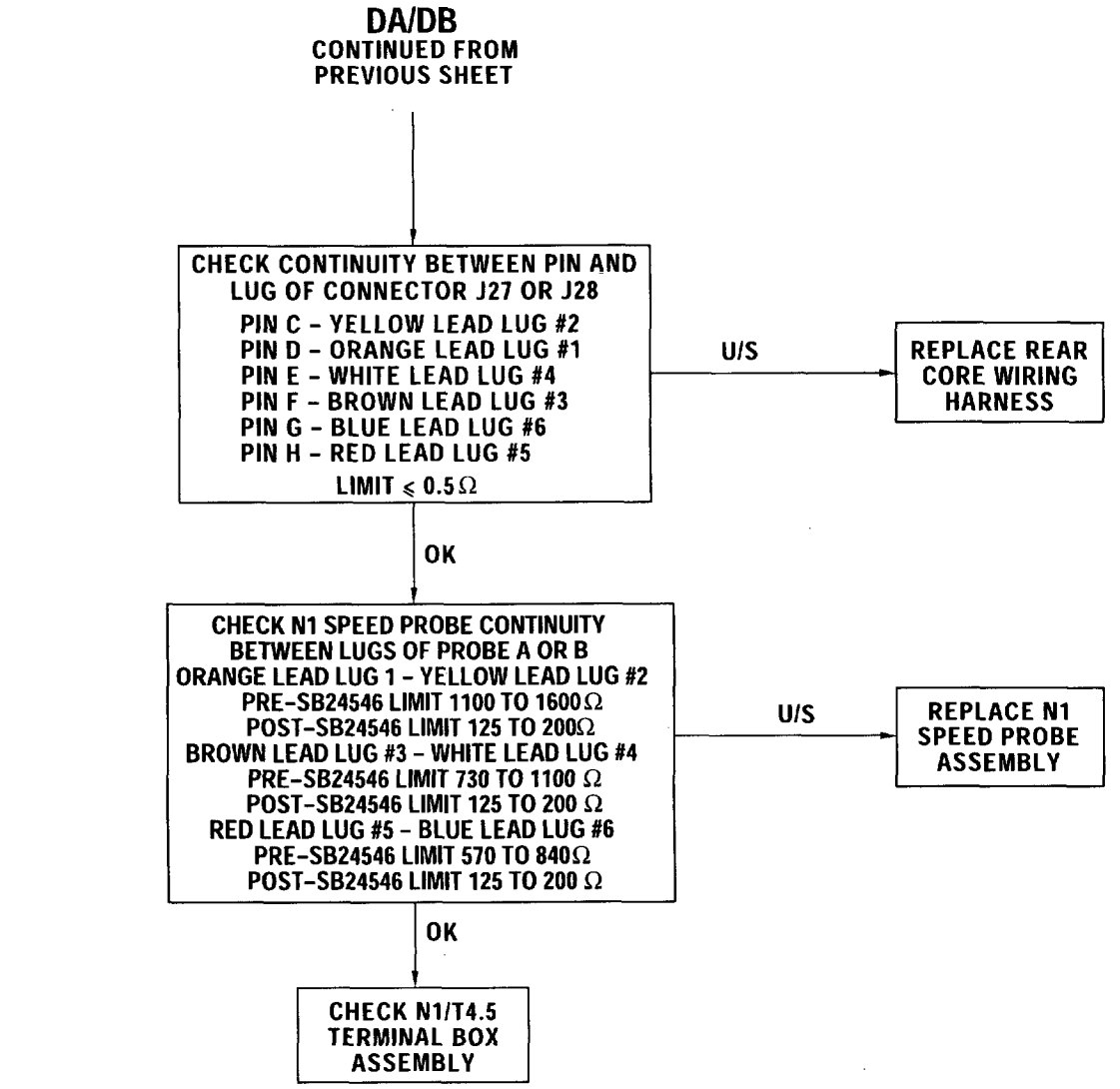
NOTE: PRIOR TO REMOVING ANY HARDWARE FLEX N1 SPEED PROBE CABLE AND RECHECK RESISTANCE / CONTINUITY.


MAKE SURE CONNECTORS P1, P4, P27, AND P28 ARE FULLY TIGHTENED
YES
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATIONS
CHECK CONTINUITY BETWEEN PINS g and G ON CONNECTOR P1 OR P4
LIMIT 1100-1600Ω
U/S
OK
CHECK INSULATION RESISTANCE BETWEEN CONNECTORS J27 OR J28 PINS C, D AND EEC GROUND STRAP
LIMIT ≥ 10MΩ
U/S
OK
REPLACE EEC
CHECK CONTINUITY BETWEEN PINS C AND D ON CONNECTOR J27 OR J28
PRE-SB24546 LIMIT 1100 TO 1600Ω
POST-SB24546 LIMIT 125 TO 200Ω
U/S
OK
REPLACE OUTER WIRING HARNESS
DISCONNECT REAR CORE WIRING HARNESS LUGS FROM N1/T4.5 TERMINAL BOX
SEE NEXT SHEET

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32901F

MFD Codes with LRU Prefix D
Figure 104 (Sheet 1 of 2)


DA/DB
CONTINUED FROM
PREVIOUS SHEET
CHECK CONTINUITY BETWEEN PIN AND LUG OF CONNECTOR J27 OR J28
PIN C - YELLOW LEAD LUG #2
PIN D - ORANGE LEAD LUG #1
PIN E - WHITE LEAD LUG #4
PIN F - BROWN LEAD LUG #3
PIN G - BLUE LEAD LUG #6
PIN H - RED LEAD LUG #5
LIMIT ≤ 0.5Ω
U/S
REPLACE REAR CORE WIRING HARNESS
OK
CHECK N1 SPEED PROBE CONTINUITY BETWEEN LUGS OF PROBE A OR B
ORANGE LEAD LUG 1 - YELLOW LEAD LUG #2
PRE-SB24546 LIMIT 1100 TO 1600Ω
POST-SB24546 LIMIT 125 TO 200Ω
BROWN LEAD LUG #3 - WHITE LEAD LUG #4
PRE-SB24546 LIMIT 730 TO 1100 Ω
POST-SB24546 LIMIT 125 TO 200 Ω
RED LEAD LUG #5 - BLUE LEAD LUG #6
PRE-SB24546 LIMIT 570 TO 840Ω
POST-SB24546 LIMIT 125 TO 200 Ω
U/S
REPLACE N1 SPEED PROBE ASSEMBLY
OK
CHECK N1/T4.5 TERMINAL BOX ASSEMBLY

FOR CHANNEL	CHECK CONNECTORS
A	P1,J27
B	P4,J28

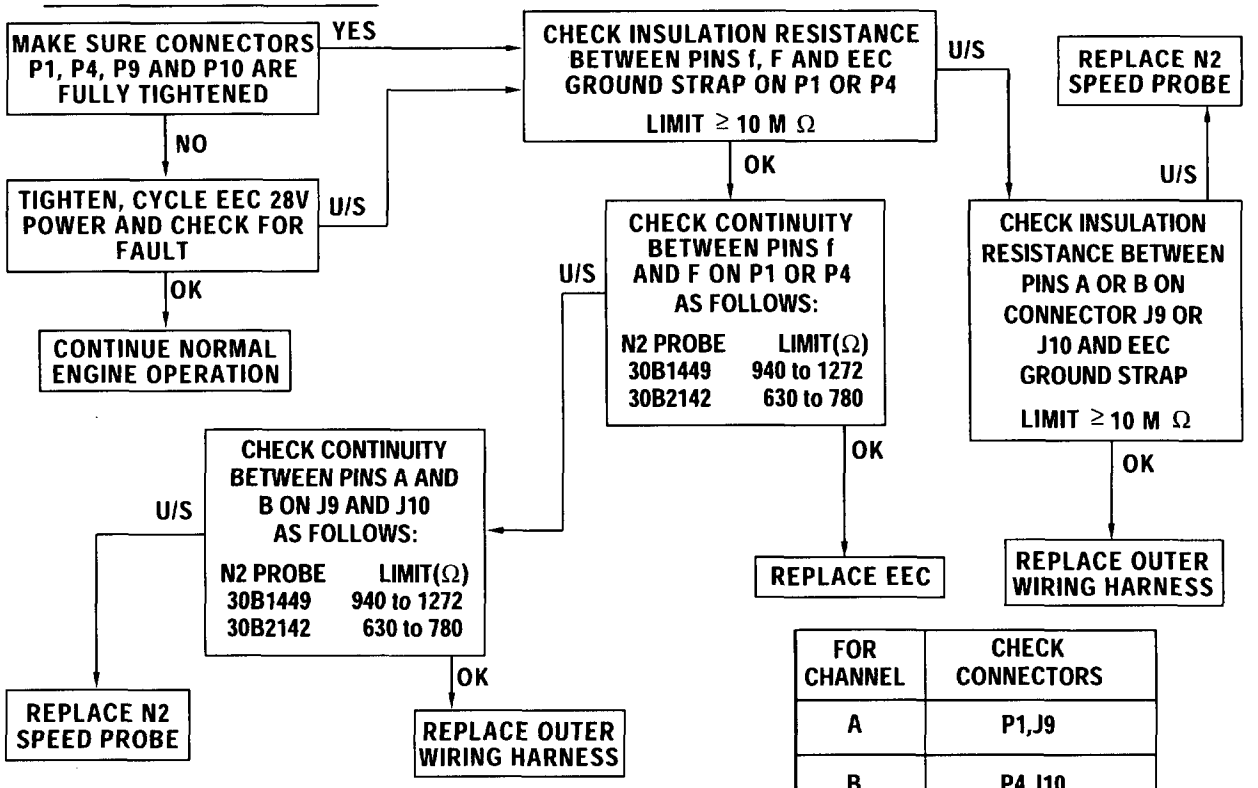
Pre-SB24434/Post-SB24514 C32994D

MFD Codes with LRU Prefix D
Figure 104 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
EA	N2 INPUT I/F	2
EB	N2 RATE OR RANGE	2

EFFECTS ON SYSTEM - Ⓓ EEC CONTROL DEFAULTS TO N2 BACK-UP LOOP AS A FUNCTION OF N1
- Ⓓ ENGINE IDLE SPEED BASED ON A FUNCTION OF N1
- Ⓓ ATTCS DISARMED
- Ⓓ IGV AND BOV SCHEDULES BASED ON A FUNCTION OF N1
- Ⓓ LOSS OF N2 SOFTWARE OVERSPEED PROTECTION
- Ⓓ POSSIBLE CHANGE IN ENGINE ACCEL AND DECEL RATES
- Ⓓ POSSIBLE ENGINE SURGING DURING ENGINE HANDLING
- Ⓢ EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P9 AND P10 ARE FULLY TIGHTENED
YES
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATION
CHECK INSULATION RESISTANCE BETWEEN PINS f, F AND EEC GROUND STRAP ON P1 OR P4
LIMIT ≥ 10 M Ω
U/S
OK
REPLACE N2 SPEED PROBE
U/S
CHECK CONTINUITY BETWEEN PINS f AND F ON P1 OR P4 AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 940 to 1272
30B2142 630 to 780
U/S
OK
REPLACE EEC
CHECK INSULATION RESISTANCE BETWEEN PINS A OR B ON CONNECTOR J9 OR J10 AND EEC GROUND STRAP
LIMIT ≥ 10 M Ω
OK
REPLACE OUTER WIRING HARNESS
CHECK CONTINUITY BETWEEN PINS A AND B ON J9 AND J10 AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 940 to 1272
30B2142 630 to 780
U/S
OK
REPLACE N2 SPEED PROBE
REPLACE OUTER WIRING HARNESS

FOR CHANNEL	CHECK CONNECTORS
A	P1,J9
B	P4,J10

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

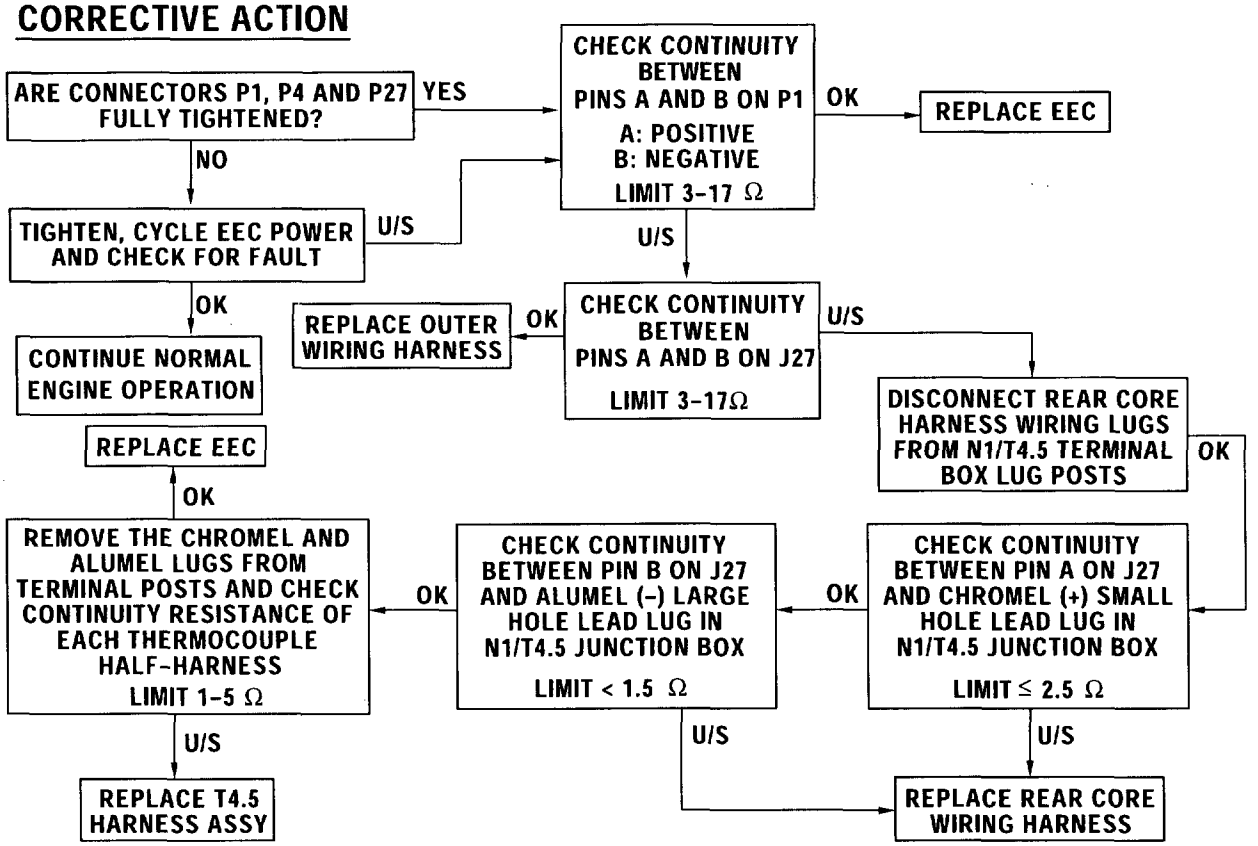
Pre-SB24434/Post-SB24514 C33721B

MFD Codes with LRU Prefix E
Figure 105

MFD CODE	FAULT	FAULT LEVEL
FA	T45 INPUT INTERFACE	2
FB	T45 RATE OR RANGE	2

EFFECTS ON SYSTEM - Ⓓ DISABLES T45 LIMITER
- Ⓓ NO T45 LIMITING ON ENGINE STARTS
- Ⓓ LOSS OF T45 COCKPIT INDICATION; INDICATION DEFAULTS TO "---"

CORRECTIVE ACTION


ARE CONNECTORS P1, P4 AND P27 FULLY TIGHTENED?
YES
NO
TIGHTEN, CYCLE EEC POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY BETWEEN PINS A AND B ON P1
A: POSITIVE
B: NEGATIVE
LIMIT 3-17 Ω
OK
REPLACE EEC
U/S
CHECK CONTINUITY BETWEEN PINS A AND B ON J27
LIMIT 3-17Ω
OK
REPLACE OUTER WIRING HARNESS
U/S
DISCONNECT REAR CORE HARNESS WIRING LUGS FROM N1/T4.5 TERMINAL BOX LUG POSTS
OK
CHECK CONTINUITY BETWEEN PIN A ON J27 AND CHROMEL (+) SMALL HOLE LEAD LUG IN N1/T4.5 JUNCTION BOX
LIMIT ≤ 2.5 Ω
OK
CHECK CONTINUITY BETWEEN PIN B ON J27 AND ALUMEL (-) LARGE HOLE LEAD LUG IN N1/T4.5 JUNCTION BOX
LIMIT < 1.5 Ω
OK
REMOVE THE CHROMEL AND ALUMEL LUGS FROM TERMINAL POSTS AND CHECK CONTINUITY RESISTANCE OF EACH THERMOCOUPLE HALF-HARNESS
LIMIT 1-5 Ω
OK
REPLACE EEC
U/S
REPLACE T4.5 HARNESS ASSY
U/S
U/S
REPLACE REAR CORE WIRING HARNESS

NOTE: Ⓓ= DUAL CHANNEL FAULT

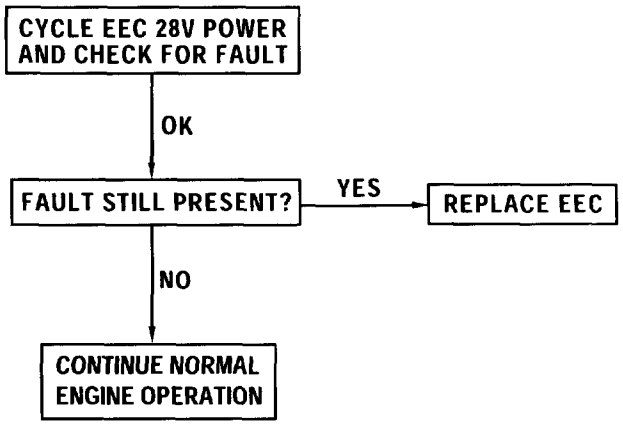
Pre-SB24434/Post-SB24514 C61047B

MFD Codes with LRU Prefix F
Figure 106

MFD CODE	FAULT	FAULT LEVEL
GA	P3 INPUT INTERFACE	2

EFFECTS ON SYSTEM - Ⓓ POSSIBLE REDUCTION IN ENGINE THRUST
- Ⓓ LOSS OF ENGINE SURGE PROTECTION

CORRECTIVE ACTION



NOTE: Ⓓ= DUAL CHANNEL FAULT

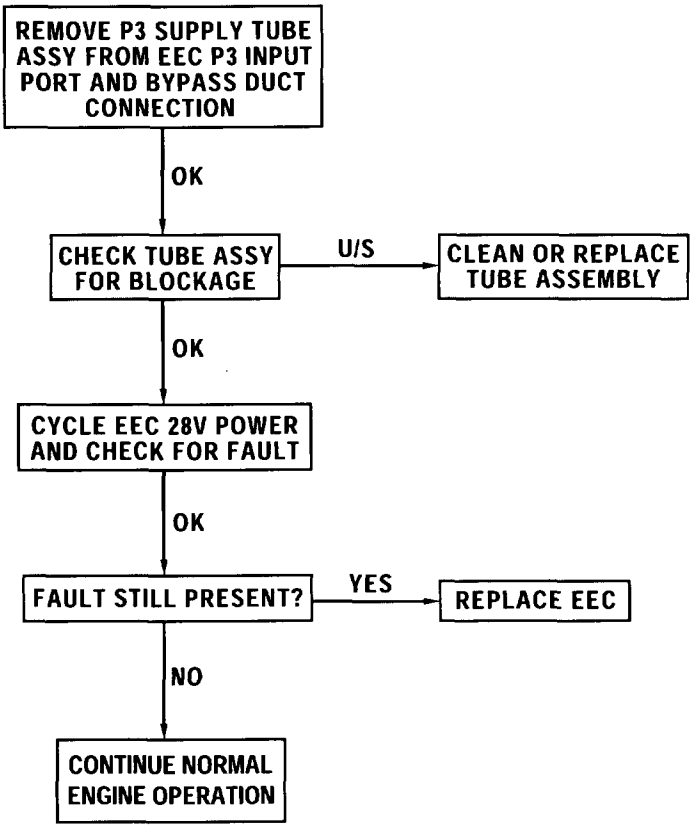
Pre-SB24434/Post-SB24514 C32907C

MFD Codes with LRU Prefix G
Figure 107 (Sheet 1 of 2)

MFD CODE	FAULT	FAULT LEVEL
GB	P3 RANGE	2

EFFECTS ON SYSTEM - Ⓓ POSSIBLE REDUCTION IN ENGINE THRUST
- Ⓓ EEC CONTROLS ON SYNTHESIZED P3 AS A FUNCTION OF CORRECTED N2 AND TOTAL INLET AIR PRESSURE

CORRECTIVE ACTION



NOTE: Ⓓ= DUAL CHANNEL FAULT

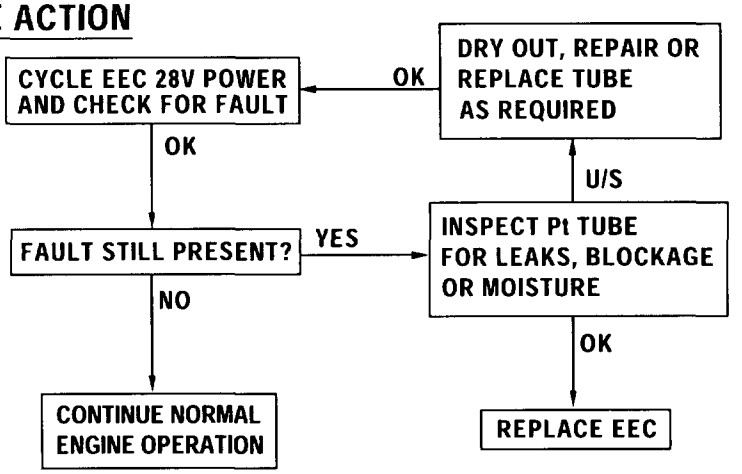
Pre-SB24434/Post-SB24514 C32908B

MFD Codes with LRU Prefix G
Figure 107 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
HA	EEC Pt INPUT INTERFACE	0

EFFECTS ON SYSTEM
- POSSIBLE CHANGE IN ENGINE THRUST IF ADC IS LOST.
- EEC CONTROLS ON SYNTHESIZED Pt AS A FUNCTION OF CORRECTED N2 AND AMBIENT AIR PRESSURE IF ADC IS LOST.

CORRECTIVE ACTION



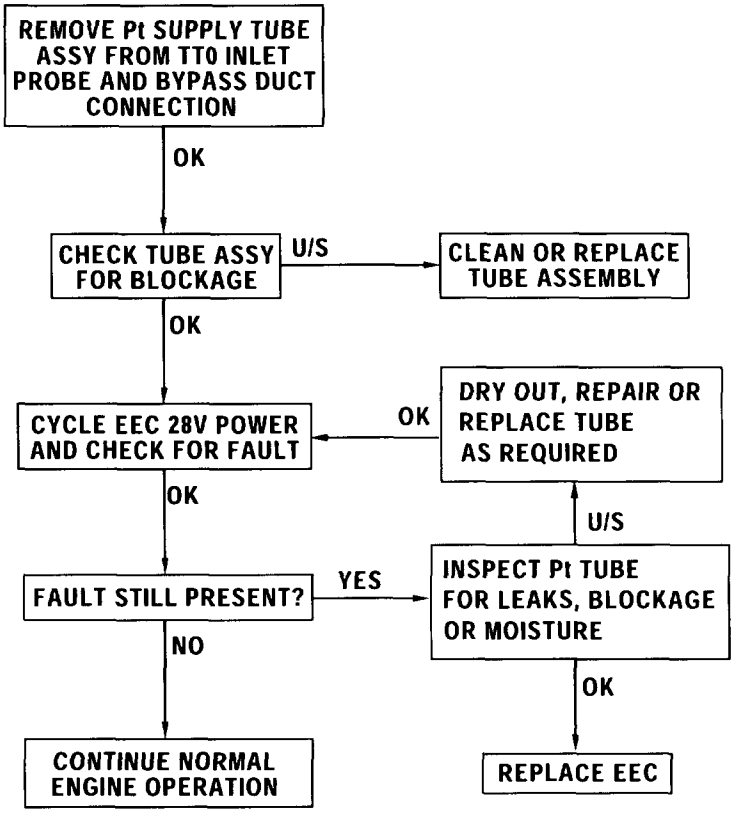
Pre-SB24434/Post-SB24514 C33924B

MFD Codes with LRU Prefix H
Figure 108 (Sheet 1 of 2)

MFD CODE	FAULT	FAULT LEVEL
HB	EEC Pt RATE OR RANGE	0

EFFECTS ON SYSTEM - POSSIBLE REDUCTION IN ENGINE THRUST IF ADC IS LOST.
- EEC CONTROLS ON SYNTHESIZED Pt AS A FUNCTION OF CORRECTED N2 AND AMBIENT AIR PRESSURE IF ADC IS LOST.
- LOSS OF N1 BUG INDICATION IF MFD CODES HB AND RB OR RA OCCUR TOGETHER. IN THIS CASE, THE FAULT BECOMES 1.

CORRECTIVE ACTION



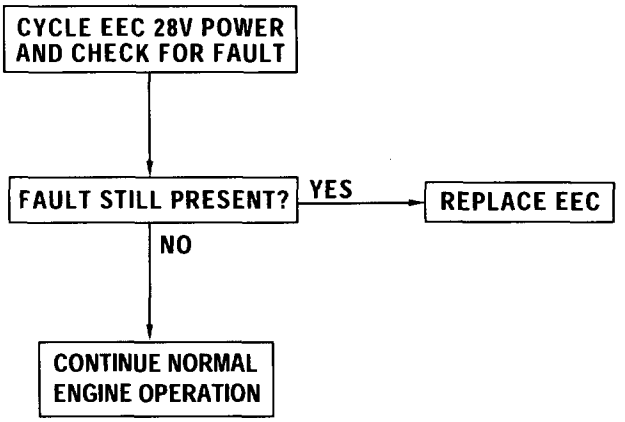
Pre-SB24434/Post-SB24514 C32910E

MFD Codes with LRU Prefix H
Figure 108 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
JA	EEC PAMB INPUT INTERFACE	0

EFFECTS ON SYSTEM - POSSIBLE CHANGE IN ENGINE THRUST IF ADC IS LOST.
- EEC CONTROLS ON SYNTHESIZED Pt AS A FUNCTION OF CORRECTED N2 AND TOTAL INLET AIR PRESSURE IF ADC IS LOST.
- EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION



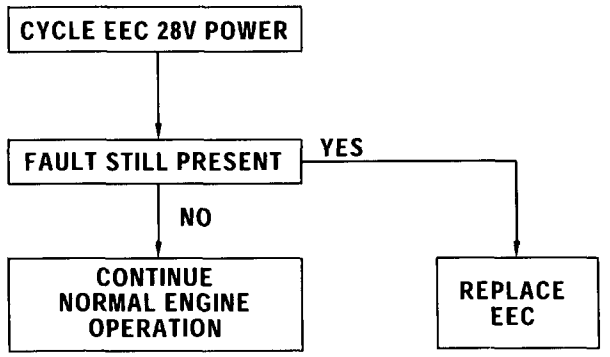
Pre-SB24434/Post-SB24514 C32911C

MFD Codes with LRU Prefix J
Figure 109 (Sheet 1 of 2)

MFD CODE	FAULT	FAULT LEVEL
JB	EEC PAMB RATE OR RANGE	0

EFFECTS ON SYSTEM - POSSIBLE REDUCTION IN ENGINE THRUST IF ADC IS LOST.
- EEC CONTROLS ON SYNTHESIZED PAMB AS A FUNCTION OF CORRECTED N2 AND TOTAL INLET AIR PRESSURE IF ADC IS LOST.
- LOSS OF N1 BUG INDICATION IF MFD CODES JB AND RC OR RA OCCUR TOGETHER . IN THIS CASE, THE FAULT LEVEL BECOMES 2.

CORRECTIVE ACTION



Pre-SB24434/Post-SB24514 C32912D

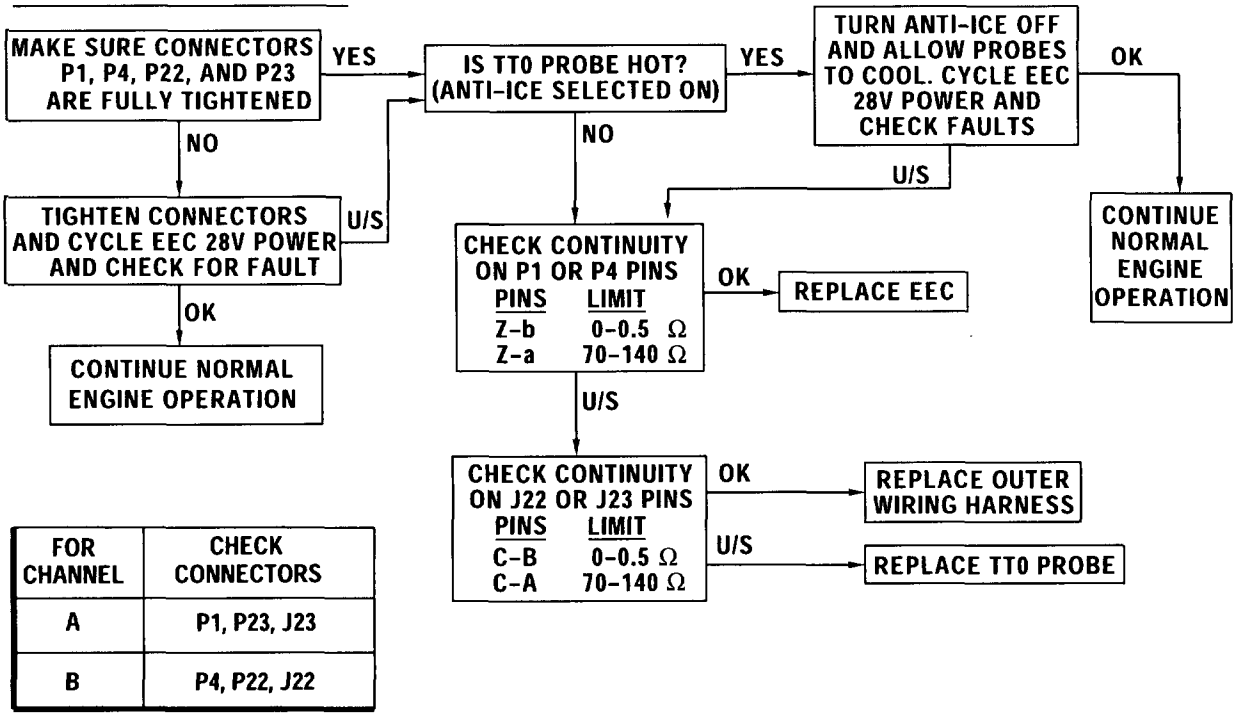
MFD Codes with LRU Prefix J
Figure 109 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
KA	TT0 INPUT INTERFACE	0

EFFECTS ON SYSTEM

- Ⓢ EEC DEFAULTS TO AIR DATA COMPUTER TT0
- Ⓢ POSSIBLE ENGINE THRUST CHANGE DUE TO DIFFERENCE BETWEEN ENGINE TT0 AND AIR DATA COMPUTER TT0
- Ⓢ POSSIBLE CHANGE IN ENGINE ACCEL AND DECEL RATES

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P1, P23, J23
B	P4, P22, J22

NOTE: Ⓢ= SINGLE CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32913D

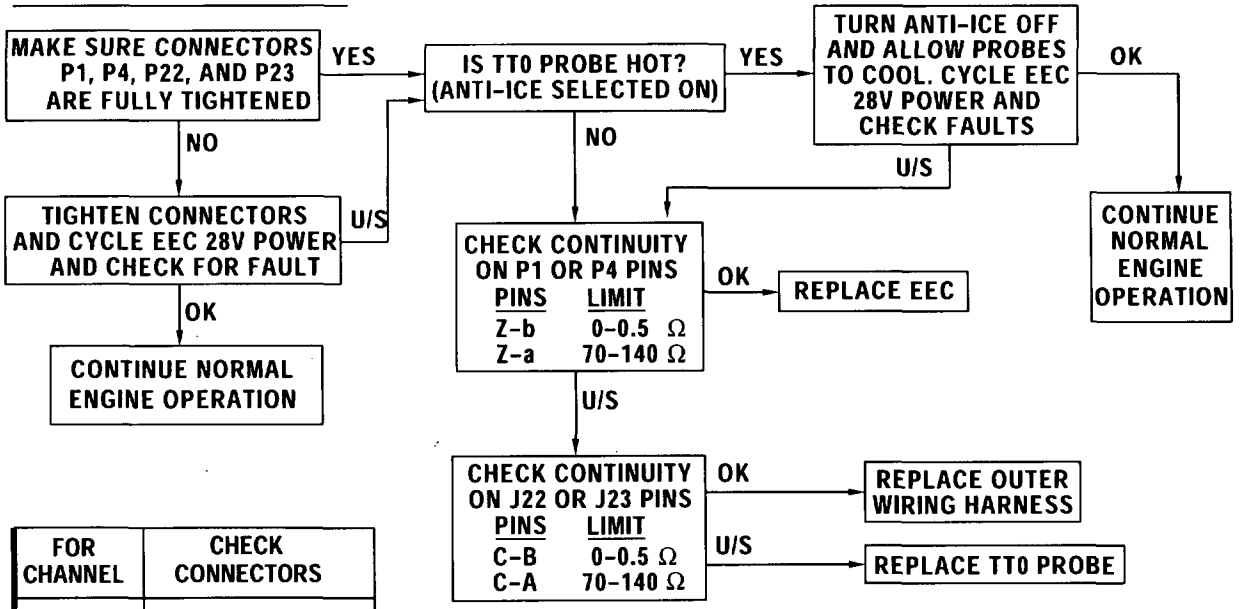
MFD Codes with LRU Prefix K
Figure 110 (Sheet 1 of 2)

MFD CODE	FAULT	FAULT LEVEL
KB	TT0 RATE OR RANGE	0

EFFECTS ON SYSTEM

- Ⓢ EEC DEFAULTS TO AIR DATA COMPUTER TT0
- Ⓢ POSSIBLE ENGINE THRUST CHANGE DUE TO DIFFERENCE BETWEEN ENGINE TT0 AND AIR DATA COMPUTER TT0
- Ⓢ POSSIBLE CHANGE IN ENGINE ACCEL AND DECEL RATES
- LOSS OF N1 BUG INDICATION IF MFD CODES KB AND RD OR RA OCCUR TOGETHER . IN THIS CASE, THE FAULT LEVEL BECOMES 2.

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P1, P23, J23
B	P4, P22, J22

NOTE: Ⓢ= SINGLE CHANNEL FAULT

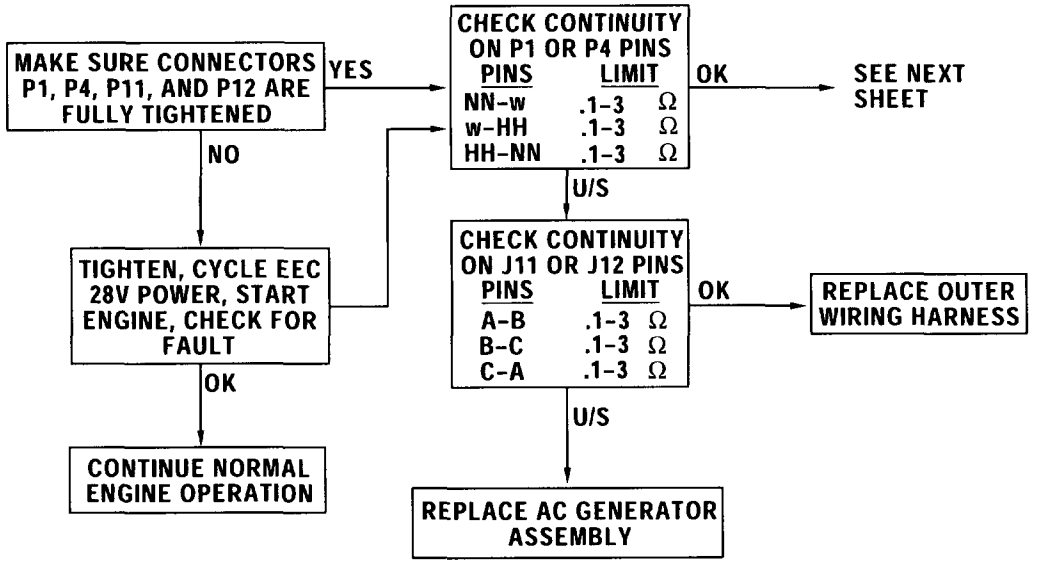
Pre-SB24434/Post-SB24514 C61049A

MFD Codes with LRU Prefix K
Figure 110 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
LA	PMA VOLTAGE FAULT	2

EFFECTS ON SYSTEM - Ⓓ LOSS OF EEC AC GENERATOR VOLTAGE SUPPLY AND EEC SWITCHES TO 28 VDC AIRCRAFT SUPPLY
- Ⓢ EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION

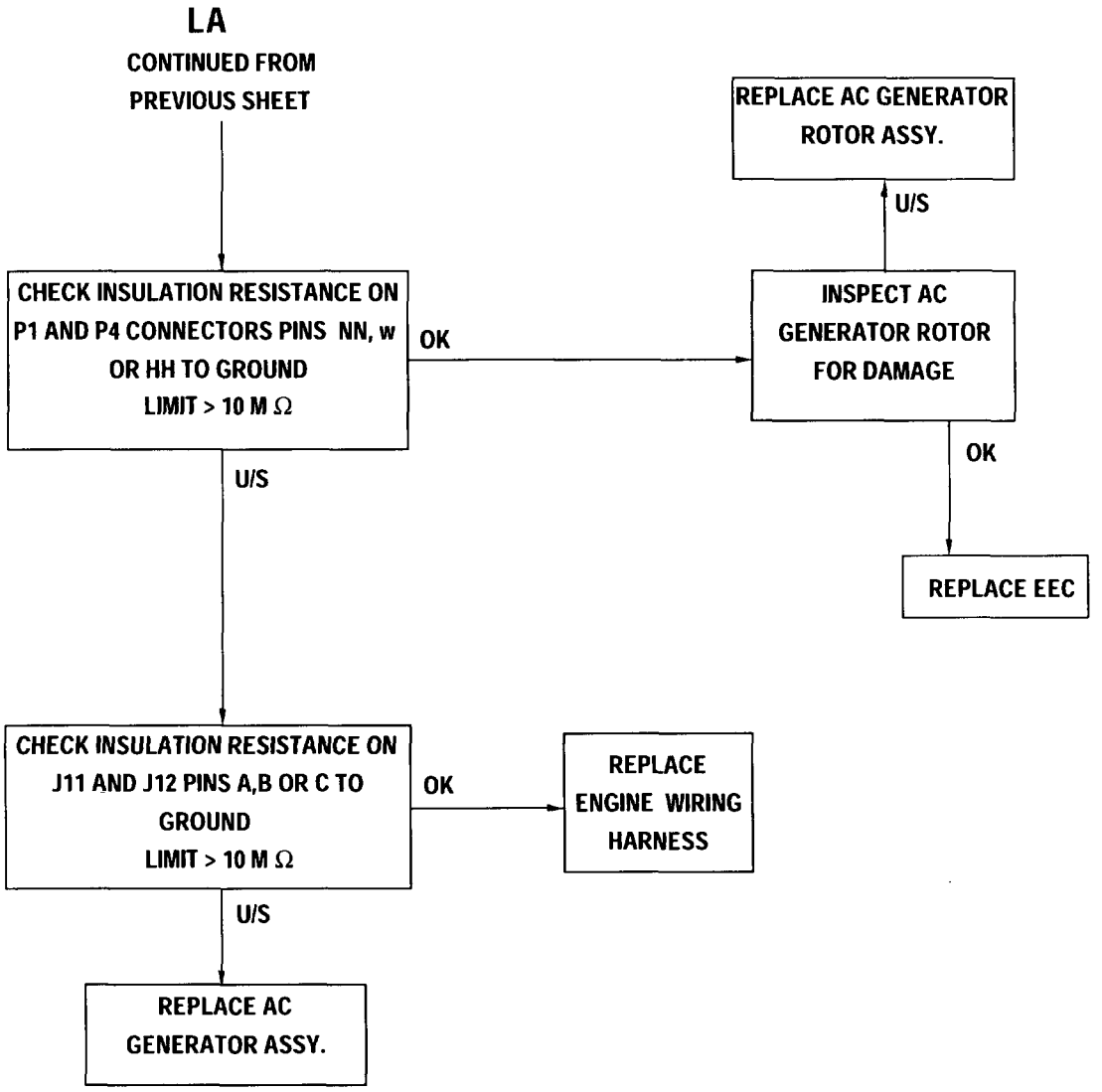


FOR CHANNEL	CHECK CONNECTORS
A	P1,J11
B	P4,J12

NOTE: Ⓢ= SINGLE CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32915E

MFD Codes with LRU Prefix L
Figure 111 (Sheet 1 of 3)


LA
CONTINUED FROM PREVIOUS SHEET
CHECK INSULATION RESISTANCE ON P1 AND P4 CONNECTORS PINS NN, w OR HH TO GROUND LIMIT > 10 M Ω
OK
INSPECT AC GENERATOR ROTOR FOR DAMAGE
U/S
REPLACE AC GENERATOR ROTOR ASSY.
OK
REPLACE EEC
U/S
CHECK INSULATION RESISTANCE ON J11 AND J12 PINS A,B OR C TO GROUND LIMIT > 10 M Ω
OK
REPLACE ENGINE WIRING HARNESS
U/S
REPLACE AC GENERATOR ASSY.

Pre-SB24434/Post-SB24514 C63212A

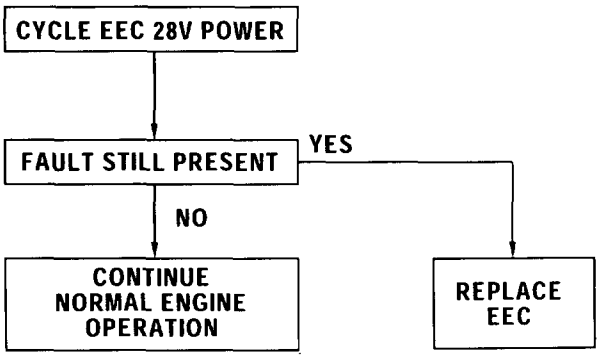
MFD Codes with LRU Prefix L
Figure 111 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
LB	AIRCRAFT DISCONNECT	1

EFFECTS ON SYSTEM - Ⓢ Ⓓ EEC WILL NOT DISCONNECT FROM AIRCRAFT 28V DC POWER BUS TO FUNCTIONAL EEC AC GENERATOR. NO IMMEDIATE EFFECT ON SYSTEM.

- Ⓢ EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION



NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32916C

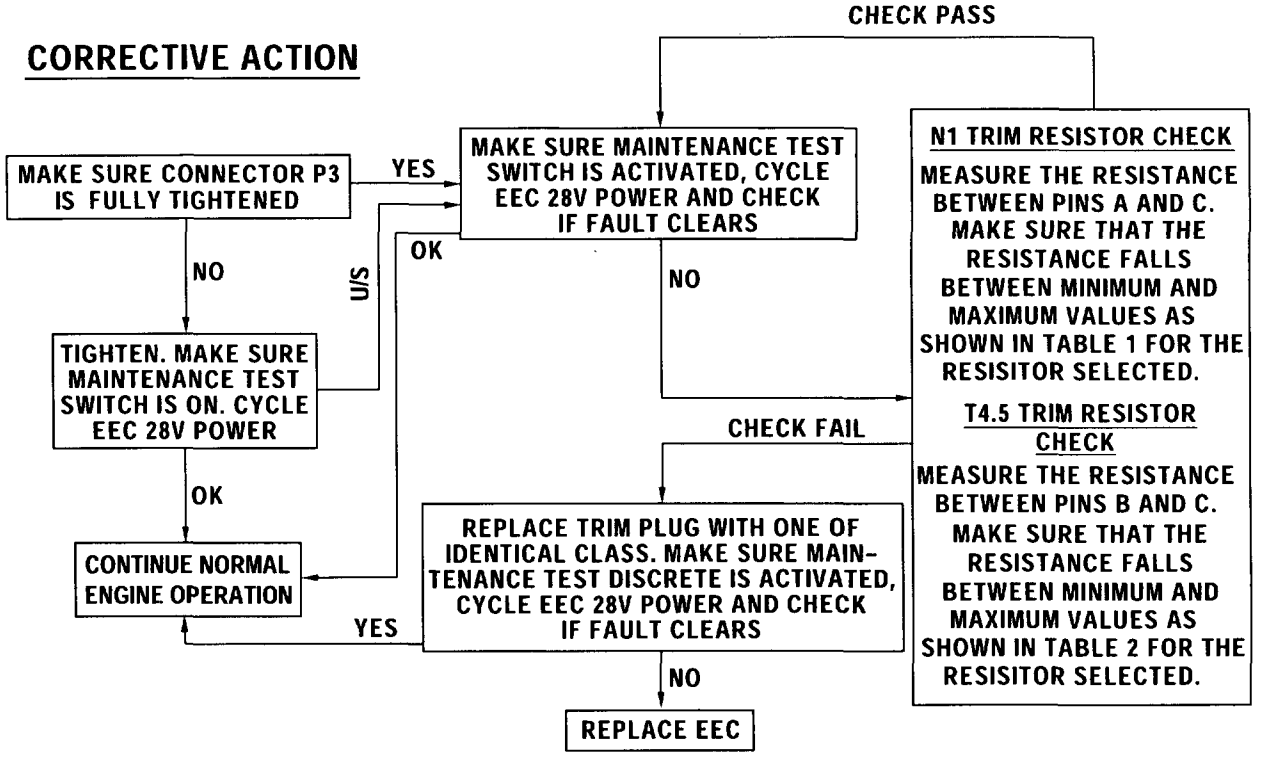
MFD Codes with LRU Prefix L
Figure 111 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
MA	INVALID TRIM PLUG STATE	1 OR 2
MC	TRIM PLUG NOT THE SAME AS TRIM PLUG IMAGE	1

EFFECTS ON SYSTEM - **MA** – Ⓢ EEC DOES NOT RECOGNIZE TRIM PLUG INPUT CONFIGURATION
EEC USES DEFAULT TRIMS IN EEPROM FROM PREVIOUS VALID TRIM PLUG INPUT
NO EEC CHANNEL SWITCHOVER
INCORRECT POWER SETTING AND T45 LIMITING / INDICATION

MC – EEC DOES NOT RECOGNIZE TRIM PLUG COMPARED TO EEROM IMAGE
EEC USES DEFAULT TRIMS IN EEPROM FROM PREVIOUS VALID TRIM PLUG INPUT
NO EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION


CHECK PASS
MAKE SURE CONNECTOR P3 IS FULLY TIGHTENED
YES
MAKE SURE MAINTENANCE TEST SWITCH IS ACTIVATED, CYCLE EEC 28V POWER AND CHECK IF FAULT CLEARS
N1 TRIM RESISTOR CHECK
MEASURE THE RESISTANCE BETWEEN PINS A AND C. MAKE SURE THAT THE RESISTANCE FALLS BETWEEN MINIMUM AND MAXIMUM VALUES AS SHOWN IN TABLE 1 FOR THE RESISITOR SELECTED.
NO
U/S
OK
NO
TIGHTEN. MAKE SURE MAINTENANCE TEST SWITCH IS ON. CYCLE EEC 28V POWER
CHECK FAIL
T4.5 TRIM RESISTOR CHECK
MEASURE THE RESISTANCE BETWEEN PINS B AND C. MAKE SURE THAT THE RESISTANCE FALLS BETWEEN MINIMUM AND MAXIMUM VALUES AS SHOWN IN TABLE 2 FOR THE RESISITOR SELECTED.
OK
CONTINUE NORMAL ENGINE OPERATION
REPLACE TRIM PLUG WITH ONE OF IDENTICAL CLASS. MAKE SURE MAINTENANCE TEST DISCRETE IS ACTIVATED, CYCLE EEC 28V POWER AND CHECK IF FAULT CLEARS
YES
NO
REPLACE EEC

NOTE: Ⓢ = SINGLE CHANNEL FAULT

Pre-SB24434/Post-SB24514 C128155

MFD Codes with LRU Prefix M
Figure 112 (Sheet 1 of 6)

MC - CONTINUED FROM SHEET 1

TABLE 1. N1 TRIM RESISTOR VALUES

TRIM CLASS	RESISTOR PART NUMBER	RESISTOR VALUE (Ω)	
		MIN.	MAX.
CL0	ST3090 - 82	613	625
CL1	ST3090 - 74	1485	1515
CL2	ST3090 - 66	2643	2697
CL3	ST3090 - 110	4227	4313
CL4	ST3090 - 34	6504	6636
CL5	ST3090 - 102	10098	10302
CL6	ST3090 - 96	16533	16867
CL7	ST3090 - 91	32076	32724

Pre-SB24434/Post-SB24514 C128156

MFD Codes with LRU Prefix M
Figure 112 (Sheet 2)

MC – CONTINUED FROM SHEET 2

TABLE 2. T4.5 TRIM RESISTOR VALUES

TRIM CLASS	T4.5 TRIM VALUE (DEG.C.)	RESISTOR PART NUMBER	RESISTOR VALUE (Ω)	
			MIN.	MAX.
CL00	0.0	ST3090 – 82	613	625
CL01	3.0	ST3090 – 80	808	824
CL02	6.0	ST3090 – 78	1030	1050
CL03	9.0	ST3090 – 76	1257	1283
CL04	12.0	ST3090 – 74	1485	1515
CL05	15.0	ST3090 –72	1762	1798
CL06	18.0	ST3090 –70	2030	2071
CL07	21.0	ST3090 – 68	2317	2363
CL08	24.0	ST3090 – 66	2643	2697
CL09	27.0	ST3090 – 64	2980	3040
CL10	30.0	ST3090 – 57	3366	3424
CL11	33.0	ST3090 – 53	3792	3868
CL12	36.0	ST3090 – 110	4227	4313
CL13	39.0	ST3090 –108	4703	4798
CL14	42.0	ST3090 – 42	5247	5353
CL15	45.0	ST3090 – 37	5841	5959
CL16	48.0	ST3090 – 34	6504	6636

Pre-SB24434/Post-SB24514 C128157

MFD Codes with LRU Prefix M
Figure 112 (Sheet 3)

MC - CONTINUED FROM SHEET 3

TABLE 2. T4.5 TRIM RESISTOR VALUES (CONT'D)

TRIM CLASS	T45 TRIM VALUE (DEG.C.)	RESISTOR PART NUMBER	RESISTOR VALUE (Ω)	
			MIN.	MAX.
CL17	51.0	ST3090 - 107	7247	7393
CL18	54.0	ST3090 - 27	8078	8242
CL19	57.0	ST3090 - 104	8999	9181
CL20	60.0	ST3090 - 102	10098	10302
CL21	63.0	ST3090 - 100	11385	11615
CL22	66.0	ST3090 - 16	12870	13130
CL23	69.0	ST3090 - 97	14553	14847
CL24	72.0	ST3090 - 96	16533	16867
CL25	75.0	ST3090 - 10	19107	19493
CL26	78.0	ST3090 - 93	22374	22826
CL27	81.0	ST3090 - 92	26433	26967
CL28	84.0	ST3090 - 91	32076	32724
CL29	87.0	ST3090 - 89	39798	40602
CL30	90.0	ST3090 - 87	51777	52823

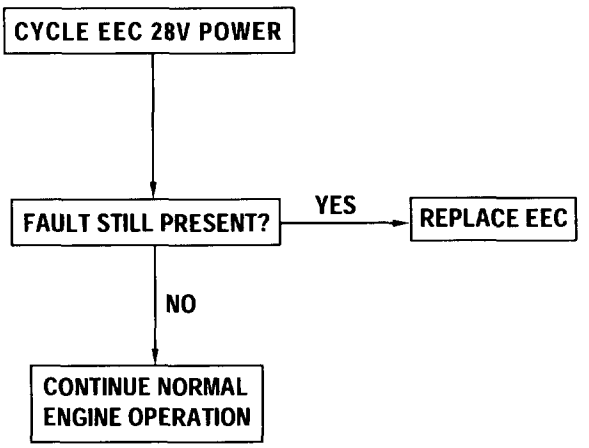
Pre-SB24434/Post-SB24514 C128158

MFD Codes with LRU Prefix M
Figure 112 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
MB	INVALID EEROM TRIM PLUG IMAGE	0

EFFECTS ON SYSTEM - EEC USES VALID TRIM PLUG INPUT
NO EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION



Pre-SB24434/Post-SB24514 C32918C

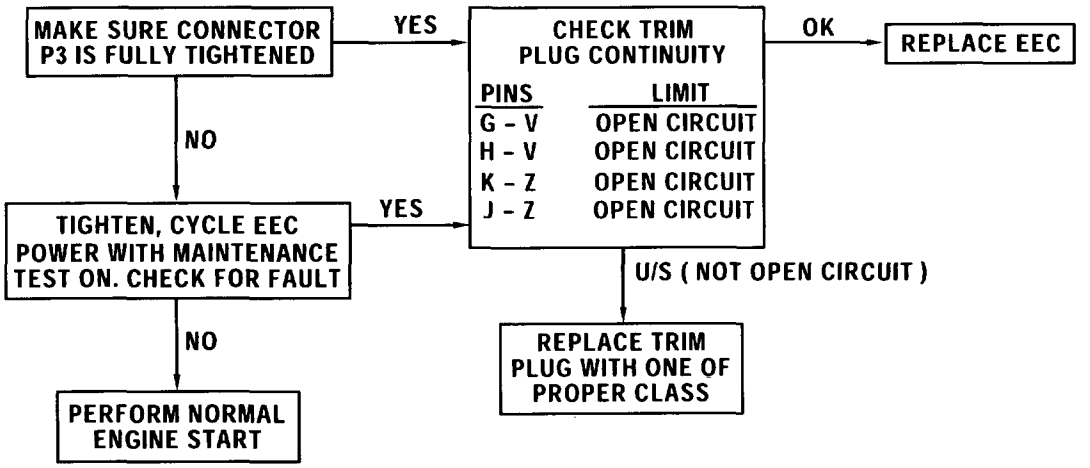
MFD Codes with LRU Prefix M
Figure 112 (Sheet 5)

MFD CODE	FAULT	FAULT LEVEL
MD PW305B ONLY	ENGINE/EEC STANDARDS INCOMPATIBLE	2

EFFECTS ON SYSTEM - SOFTWARE TEMPERATURE LIMITS DIFFERENT FROM HARDWARE TEMPERATURE LIMITS.

- DAMAGE TO ENGINE MAY RESULT.

CORRECTIVE ACTION



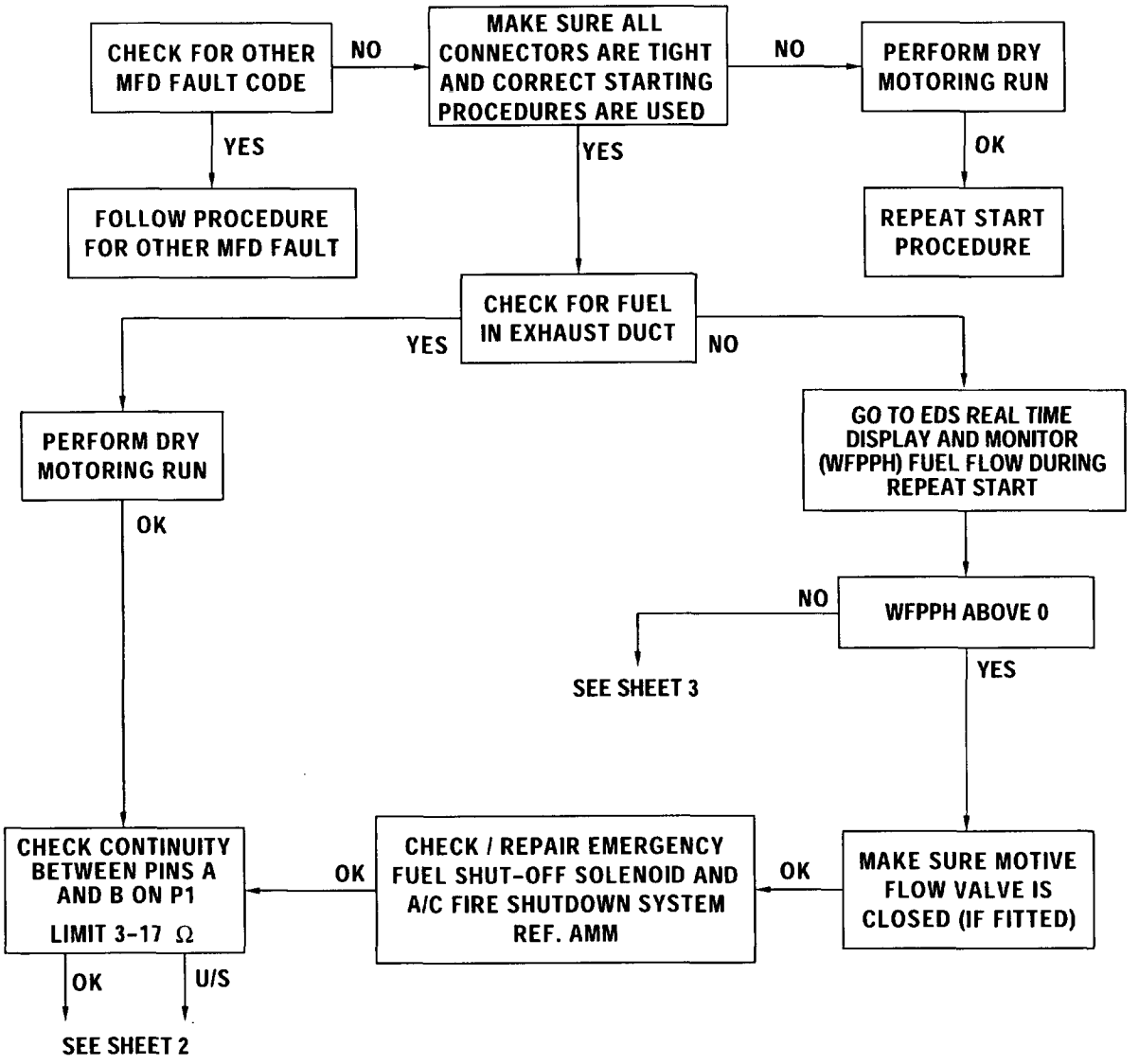
Pre-SB24434/Post-SB24514 C33165B

MFD Codes with LRU Prefix M
Figure 112 (Sheet 6)

MFD CODE	FAULT	FAULT LEVEL
NC	ENGINE LIGHT UP FAIL	2

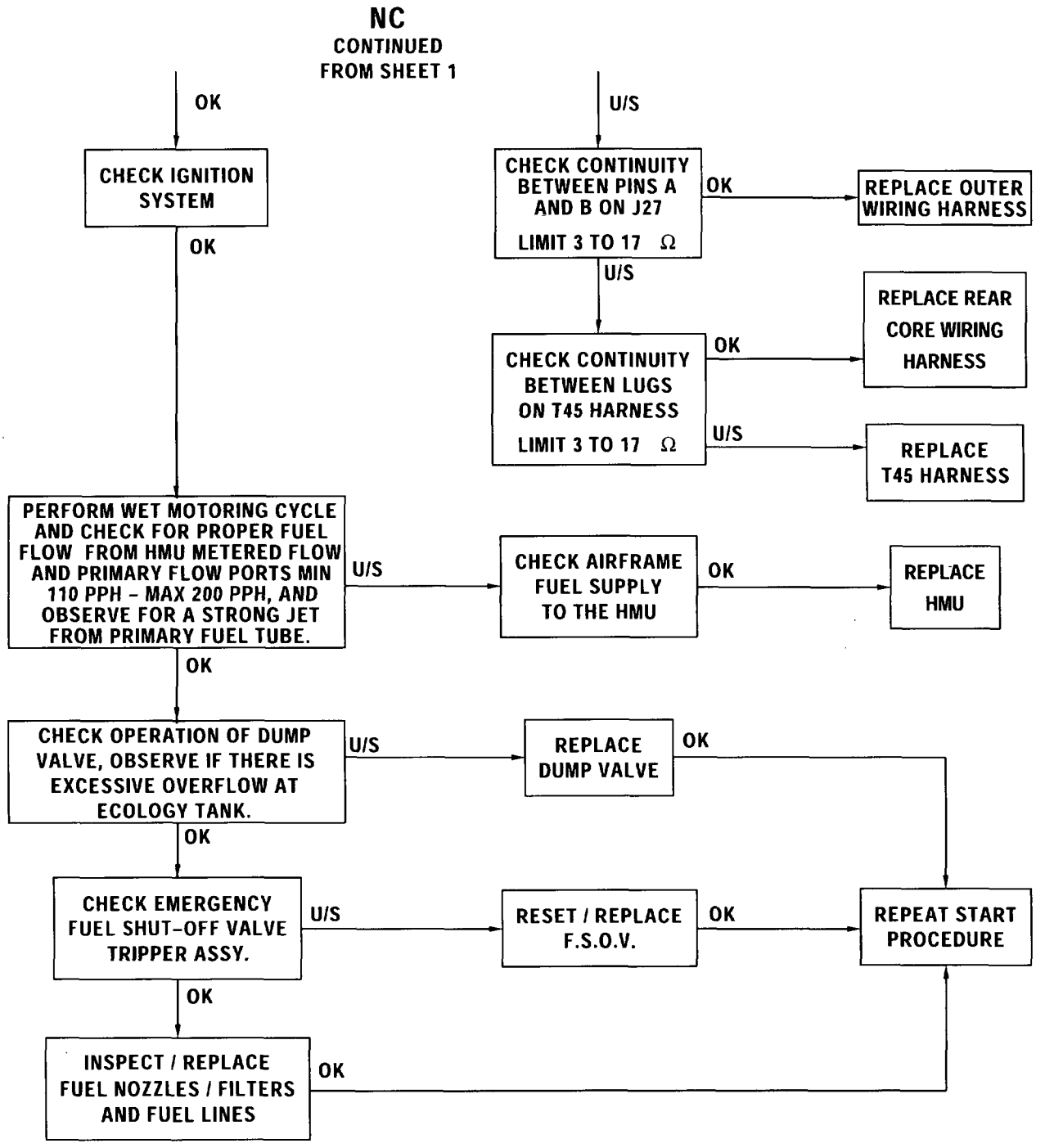
EFFECTS ON SYSTEM - ABORTED START DUE TO LOW T45 (ITT) 15 SECONDS AFTER FUEL-ON.

CORRECTIVE ACTION



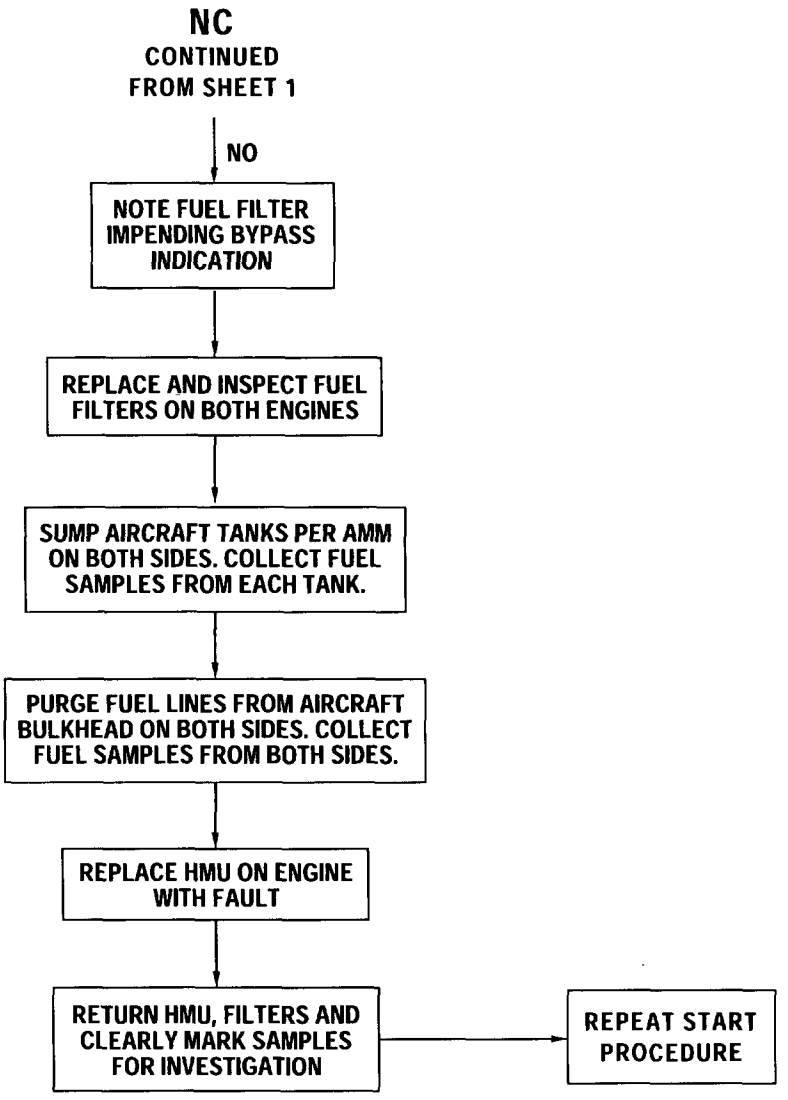
Pre-SB24434/Post-SB24514 C33722B

MFD Codes with LRU Prefix N
Figure 113 (Sheet 1 of 4)


NC
CONTINUED
FROM SHEET 1
OK
CHECK IGNITION SYSTEM
OK
U/S
CHECK CONTINUITY BETWEEN PINS A AND B ON J27
LIMIT 3 TO 17 Ω
OK
REPLACE OUTER WIRING HARNESS
U/S
CHECK CONTINUITY BETWEEN LUGS ON T45 HARNESS
LIMIT 3 TO 17 Ω
OK
REPLACE REAR CORE WIRING HARNESS
U/S
REPLACE T45 HARNESS
PERFORM WET MOTORING CYCLE AND CHECK FOR PROPER FUEL FLOW FROM HMU METERED FLOW AND PRIMARY FLOW PORTS MIN 110 PPH - MAX 200 PPH, AND OBSERVE FOR A STRONG JET FROM PRIMARY FUEL TUBE.
U/S
CHECK AIRFRAME FUEL SUPPLY TO THE HMU
OK
REPLACE HMU
OK
CHECK OPERATION OF DUMP VALVE, OBSERVE IF THERE IS EXCESSIVE OVERFLOW AT ECOLOGY TANK.
U/S
REPLACE DUMP VALVE
OK
OK
CHECK EMERGENCY FUEL SHUT-OFF VALVE TRIPPER ASSY.
U/S
RESET / REPLACE F.S.O.V.
OK
REPEAT START PROCEDURE
OK
INSPECT / REPLACE FUEL NOZZLES / FILTERS AND FUEL LINES
OK

Pre-SB24434/Post-SB24514 C33723B

MFD Codes with LRU Prefix N
Figure 113 (Sheet 2)


NC
CONTINUED
FROM SHEET 1
NO
NOTE FUEL FILTER IMPENDING BYPASS INDICATION
REPLACE AND INSPECT FUEL FILTERS ON BOTH ENGINES
SUMP AIRCRAFT TANKS PER AMM ON BOTH SIDES. COLLECT FUEL SAMPLES FROM EACH TANK.
PURGE FUEL LINES FROM AIRCRAFT BULKHEAD ON BOTH SIDES. COLLECT FUEL SAMPLES FROM BOTH SIDES.
REPLACE HMU ON ENGINE WITH FAULT
RETURN HMU, FILTERS AND CLEARLY MARK SAMPLES FOR INVESTIGATION
REPEAT START PROCEDURE

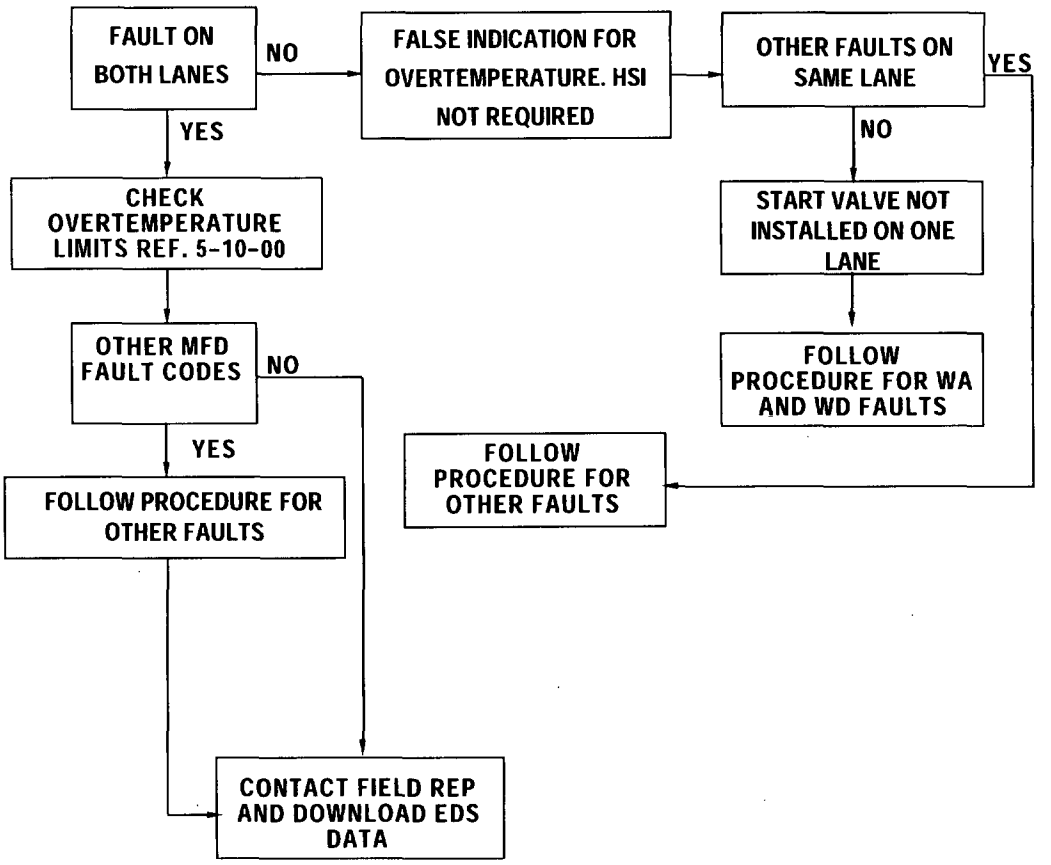
Pre-SB24434/Post-SB24514 C69868

MFD Codes with LRU Prefix N
Figure 113 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
ND	T45 START LIMIT EXCEEDED	2

EFFECTS ON SYSTEM - ATTEMPTED ENGINE START FOLLOWED BY AN ABORTED START DUE TO HIGH T45 (ITT) INDICATION
- ENGINE SHUT DOWN

CORRECTIVE ACTION



Pre-SB24434/Post-SB24514 C62179B

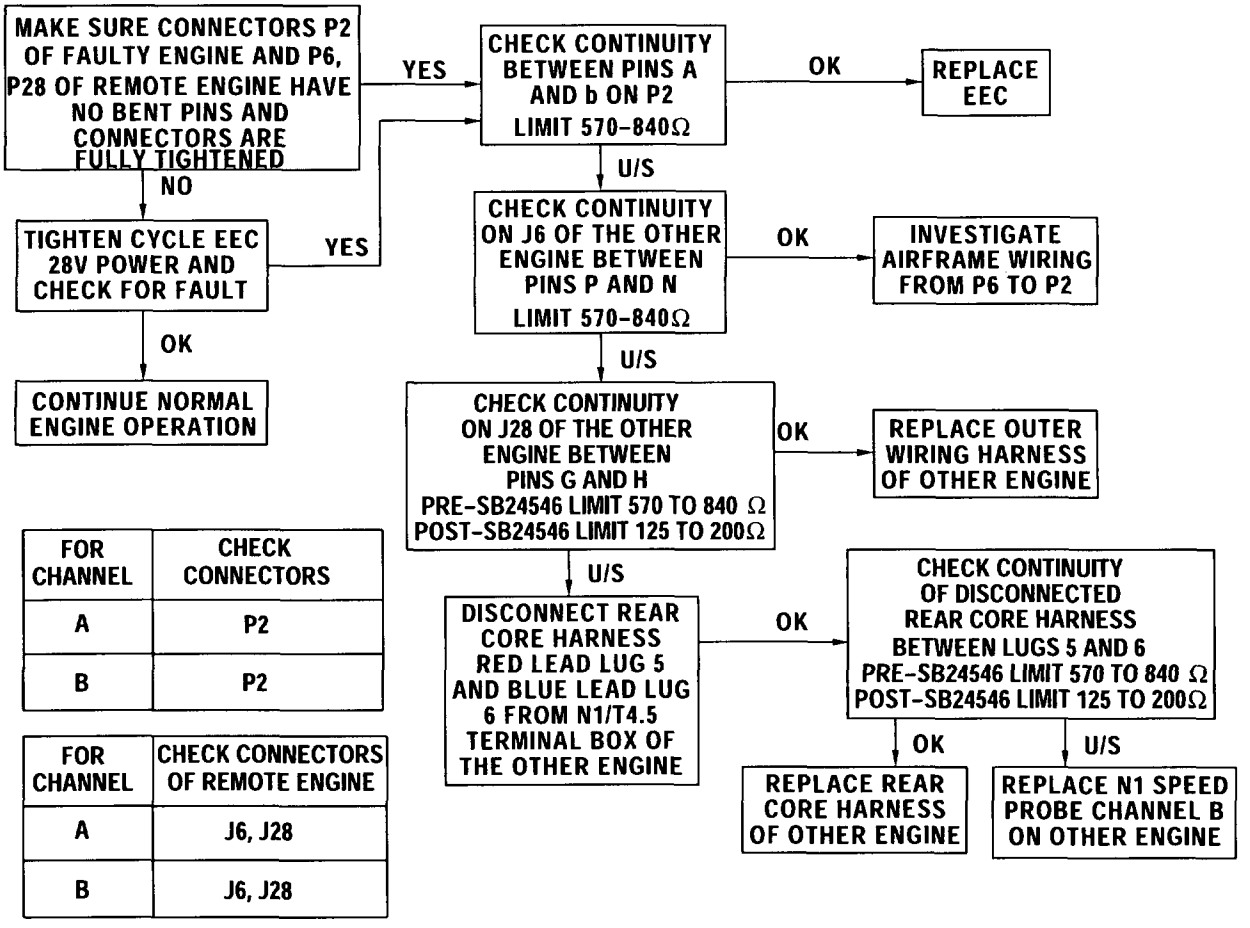
MFD Codes with LRU Prefix N
Figure 113 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
PA	N1R RATE OR RANGE	1

EFFECTS ON SYSTEM - Ⓓ ATTCS TRIGGER WOULD BE BASED ON N2R ONLY.
- Ⓓ LOSS OF SYNCHRONIZATION.

CORRECTIVE ACTION

NOTE: PRIOR TO REMOVING ANY HARDWARE FLEX N1 SPEED PROBE CABLE AND RECHECK RESISTANCE / CONTINUITY.


MAKE SURE CONNECTORS P2 OF FAULTY ENGINE AND P6, P28 OF REMOTE ENGINE HAVE NO BENT PINS AND CONNECTORS ARE FULLY TIGHTENED
YES
CHECK CONTINUITY BETWEEN PINS A AND b ON P2 LIMIT 570-840Ω
OK
REPLACE EEC
U/S
NO
TIGHTEN CYCLE EEC 28V POWER AND CHECK FOR FAULT
YES
CHECK CONTINUITY ON J6 OF THE OTHER ENGINE BETWEEN PINS P AND N LIMIT 570-840Ω
OK
INVESTIGATE AIRFRAME WIRING FROM P6 TO P2
U/S
OK
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY ON J28 OF THE OTHER ENGINE BETWEEN PINS G AND H PRE-SB24546 LIMIT 570 TO 840 Ω POST-SB24546 LIMIT 125 TO 200Ω
OK
REPLACE OUTER WIRING HARNESS OF OTHER ENGINE
U/S
DISCONNECT REAR CORE HARNESS RED LEAD LUG 5 AND BLUE LEAD LUG 6 FROM N1/T4.5 TERMINAL BOX OF THE OTHER ENGINE
OK
CHECK CONTINUITY OF DISCONNECTED REAR CORE HARNESS BETWEEN LUGS 5 AND 6 PRE-SB24546 LIMIT 570 TO 840 Ω POST-SB24546 LIMIT 125 TO 200Ω
OK
REPLACE REAR CORE HARNESS OF OTHER ENGINE
U/S
REPLACE N1 SPEED PROBE CHANNEL B ON OTHER ENGINE

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P2

FOR CHANNEL	CHECK CONNECTORS OF REMOTE ENGINE
A	J6, J28
B	J6, J28

NOTE: Ⓓ= DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C33741C

MFD Codes with LRU Prefix P
Figure 114 (Sheet 1 of 5)

MFD CODE	FAULT	FAULT LEVEL
PB	N1R RATE OR RANGE	1

EFFECTS ON SYSTEM - Ⓢ ATTCS TRIGGER WOULD BE BASED ON N2R ONLY.
- Ⓢ LOSS OF SYNCHRONIZATION.

CORRECTIVE ACTION

NOTE: PRIOR TO REMOVING HARDWARE FLEX N1 SPEED PROBE CABLE AND RECHECK RESISTANCE / CONTINUITY.

MAKE SURE CONNECTORS P2 OF FAULTY ENGINE AND P6, P28 OF REMOTE ENGINE HAVE NO BENT PINS AND CONNECTORS ARE FULLY TIGHTENED

YES → DISCONNECT THE P2 CONNECTOR AND MEASURE THE CONTINUITY FROM PIN A TO PIN b
LIMITS: PRE-SB24546 570-840 Ω
LIMITS: POST-SB24546 125-200 Ω
MEASURE INSULATION RESISTANCE FROM THE SAME PINS TO GROUND
LIMIT ≥ 10 MEG Ω
ARE THEY SATISFACTORY?

YES → COMPLETE THE EEC RETURN SHEET AND REPLACE THE EEC (REF. 73-20-02)

NO → TIGHTEN CYCLE EEC 28V POWER AND CHECK FOR FAULT

YES → DISCONNECT THE P2 CONNECTOR AND MEASURE THE CONTINUITY FROM PIN A TO PIN b
LIMITS: PRE-SB24546 570-840 Ω
LIMITS: POST-SB24546 125-200 Ω
MEASURE INSULATION RESISTANCE FROM THE SAME PINS TO GROUND
LIMIT ≥ 10 MEG Ω
ARE THEY SATISFACTORY?

NO → CONTINUE NORMAL ENGINE OPERATION

NO → MEASURE THE CONTINUITY AT J6 ON THE REMOTE ENGINE FROM PIN P TO PIN N
LIMITS: PRE-SB24546 570-840 Ω
LIMITS: POST-SB24546 125-200 Ω
MEASURE INSULATION RESISTANCE FROM THE SAME PINS TO GROUND
LIMIT ≥ 10 MEG Ω
ARE THEY SATISFACTORY?

YES → INVESTIGATE AIRFRAME WIRING FROM P6 TO P2 (REF. AMM)

NO → MEASURE THE CONTINUITY AT J28 ON THE REMOTE ENGINE FROM PIN G TO PIN H
LIMITS: PRE-SB24546 570-840 Ω
LIMITS: POST-SB24546 125-200 Ω
MEASURE INSULATION RESISTANCE FROM THE SAME PINS TO GROUND
LIMIT ≥ 10 MEG Ω
ARE THEY SATISFACTORY?

YES → REPLACE THE OUTER WIRING HARNESS ON REMOTE ENGINE (REF. 73-20-03)

NO → DISCONNECT THE REMOTE ENGINE'S CHANNEL B N1 SENSOR AT THE TERMINAL BOX (REF. 77-20-01) AND MEASURE CONTINUITY FROM THE RED LEAD TO BLUE LEAD
LIMITS: PRE-SB24546 570-840Ω , POST-SB24546 125-200Ω
MEASURE INSULATION RESISTANCE FROM ORANGE TO BROWN, AND ORANGE TO RED, AND BROWN TO RED, AND FROM ALL LEADS INDIVIDUALLY TO GROUND.
LIMIT ≥ 10 MEGΩ. ARE THEY SATISFACTORY?

CONTINUED ON SHEET 2

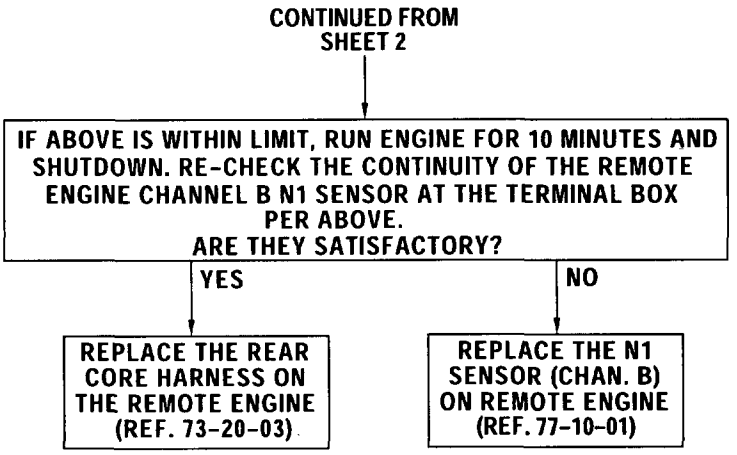
FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P2

FOR CHANNEL	CHECK CONNECTORS OF REMOTE ENGINE
A	J6, J28
B	J6, J28

NOTE: Ⓢ= SINGLE CHANNEL FAULT

Pre-SB24434/Post-SB24514 C32924H

MFD Codes with LRU Prefix P
Figure 114 (Sheet 2)


CONTINUED FROM
SHEET 2
IF ABOVE IS WITHIN LIMIT, RUN ENGINE FOR 10 MINUTES AND SHUTDOWN. RE-CHECK THE CONTINUITY OF THE REMOTE ENGINE CHANNEL B N1 SENSOR AT THE TERMINAL BOX PER ABOVE.
ARE THEY SATISFACTORY?
YES
NO
REPLACE THE REAR CORE HARNESS ON THE REMOTE ENGINE (REF. 73-20-03)
REPLACE THE N1 SENSOR (CHAN. B) ON REMOTE ENGINE (REF. 77-10-01)

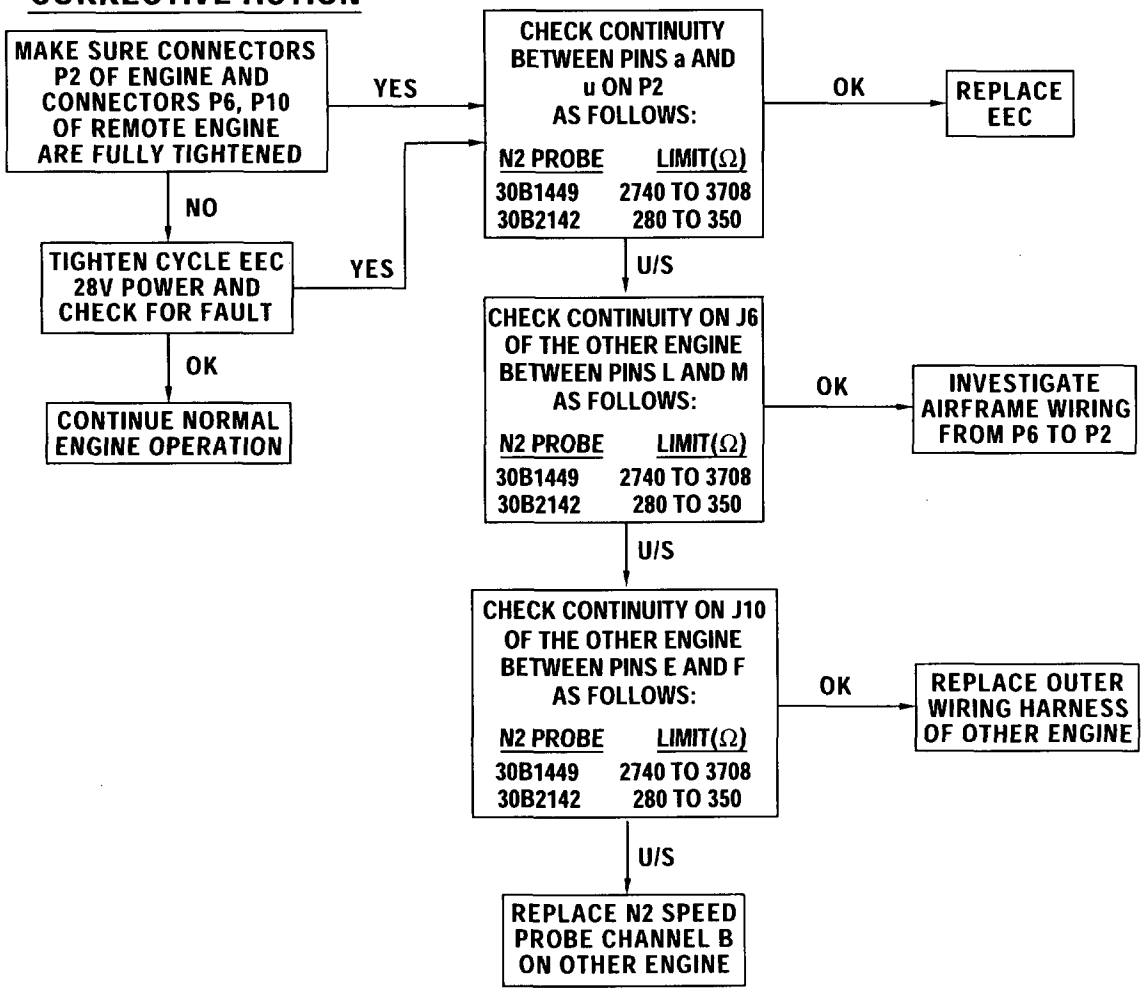
Pre-SB24434/Post-SB24514 C150413

MFD Codes with LRU Prefix P
Figure 114 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
PC	N2R INPUT INTERFACE	1

EFFECTS ON SYSTEM - ATTCS TRIGGER WOULD BE BASED ON N1R ONLY.
- LOSS OF SYNCHRONIZATION.

CORRECTIVE ACTION


MAKE SURE CONNECTORS P2 OF ENGINE AND CONNECTORS P6, P10 OF REMOTE ENGINE ARE FULLY TIGHTENED
YES
NO
TIGHTEN CYCLE EEC 28V POWER AND CHECK FOR FAULT
YES
OK
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY BETWEEN PINS a AND u ON P2 AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 2740 TO 3708
30B2142 280 TO 350
OK
REPLACE EEC
U/S
CHECK CONTINUITY ON J6 OF THE OTHER ENGINE BETWEEN PINS L AND M AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 2740 TO 3708
30B2142 280 TO 350
OK
INVESTIGATE AIRFRAME WIRING FROM P6 TO P2
U/S
CHECK CONTINUITY ON J10 OF THE OTHER ENGINE BETWEEN PINS E AND F AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 2740 TO 3708
30B2142 280 TO 350
OK
REPLACE OUTER WIRING HARNESS OF OTHER ENGINE
U/S
REPLACE N2 SPEED PROBE CHANNEL B ON OTHER ENGINE

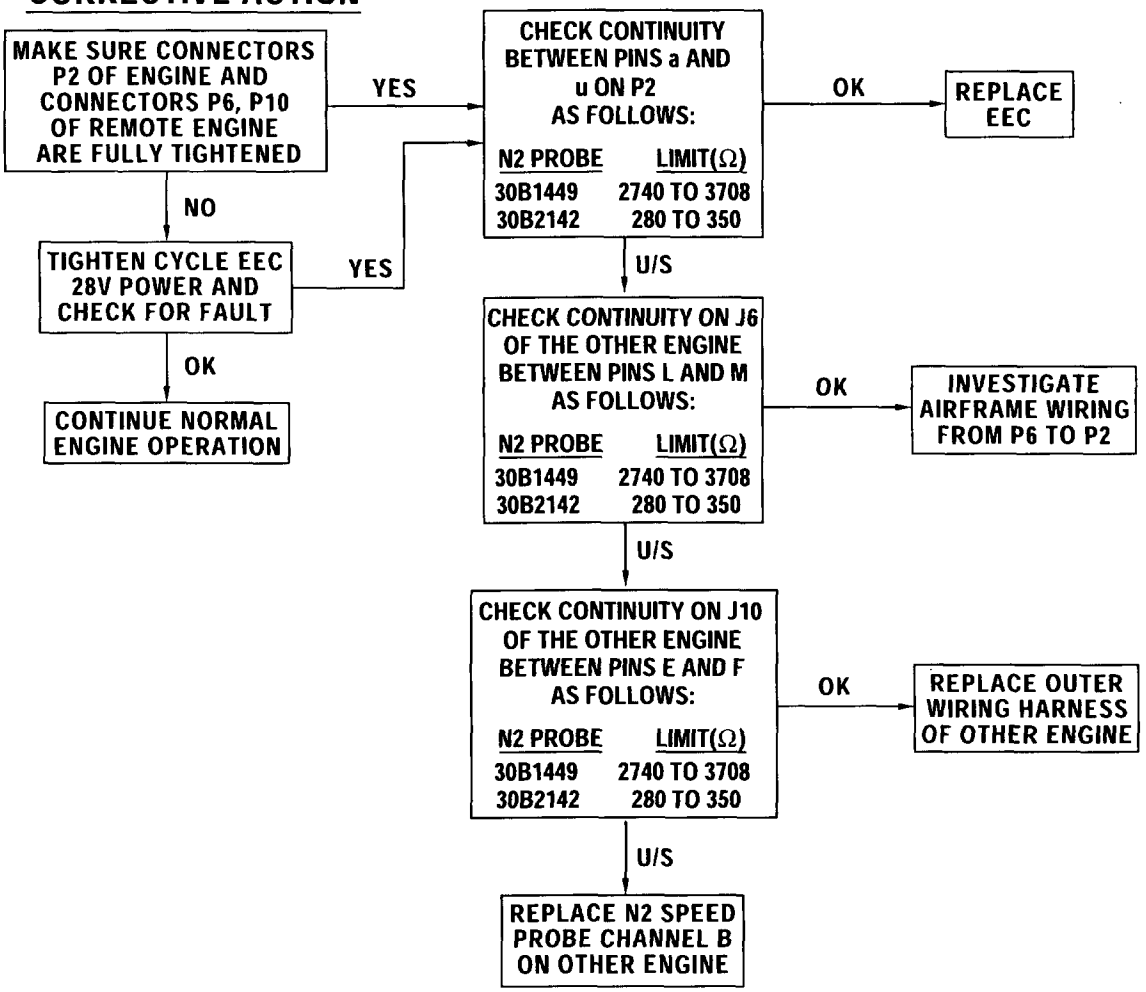
Pre-SB24434/Post-SB24514 C33742B

MFD Codes with LRU Prefix P
Figure 114 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
PD	N2R RATE OR RANGE	1

EFFECTS ON SYSTEM - ATTCS TRIGGER WOULD BE BASED ON N1R ONLY
- LOSS OF SYNCHRONIZATION.

CORRECTIVE ACTION


MAKE SURE CONNECTORS P2 OF ENGINE AND CONNECTORS P6, P10 OF REMOTE ENGINE ARE FULLY TIGHTENED
YES
NO
TIGHTEN CYCLE EEC 28V POWER AND CHECK FOR FAULT
YES
OK
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY BETWEEN PINS a AND u ON P2 AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 2740 TO 3708
30B2142 280 TO 350
OK
REPLACE EEC
U/S
CHECK CONTINUITY ON J6 OF THE OTHER ENGINE BETWEEN PINS L AND M AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 2740 TO 3708
30B2142 280 TO 350
OK
INVESTIGATE AIRFRAME WIRING FROM P6 TO P2
U/S
CHECK CONTINUITY ON J10 OF THE OTHER ENGINE BETWEEN PINS E AND F AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 2740 TO 3708
30B2142 280 TO 350
OK
REPLACE OUTER WIRING HARNESS OF OTHER ENGINE
U/S
REPLACE N2 SPEED PROBE CHANNEL B ON OTHER ENGINE

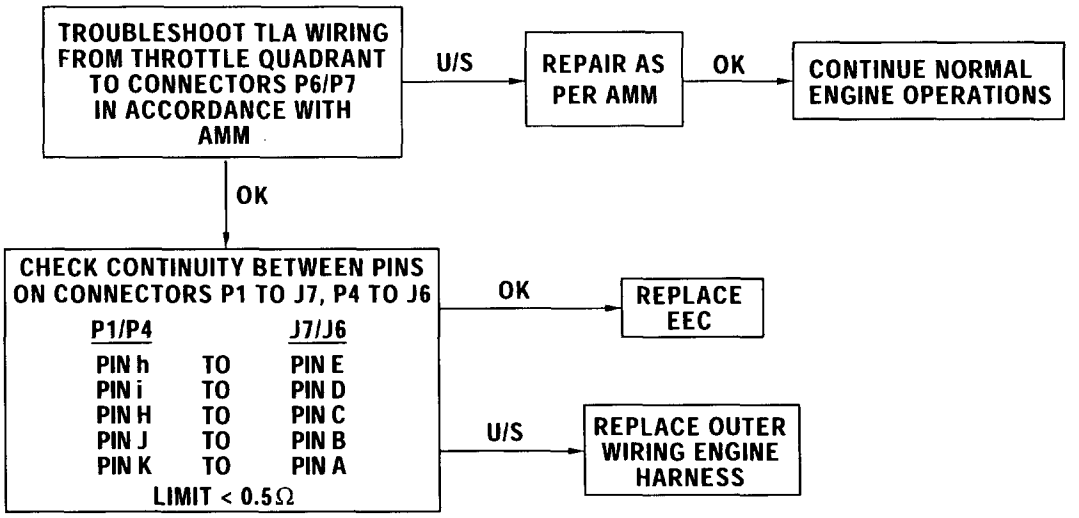
Pre-SB24434/Post-SB24514 C32926D

MFD Codes with LRU Prefix P
Figure 114 (Sheet 5)

MFD CODE	FAULT	FAULT LEVEL
QA	TLA INPUT INTERFACE	3

EFFECTS ON SYSTEM - Ⓓ POSSIBLE ENGINE FLAMEOUT
- Ⓓ LOSS OF THROTTLE LEVER POSITION
- Ⓓ TLA DEFAULTS TO IDLE POSITION
- Ⓓ ENGINE DOES NOT RESPOND TO TLA MOVEMENT
- Ⓓ ENGINE REMAINS AT IDLE
- Ⓢ EEC CHANNEL SWITCHOVER
- Ⓓ LOSS OF N1 BUG INDICATION
- Ⓢ POSSIBLE FAULT MFD CODE - AA

CORRECTIVE ACTION


TROUBLESHOOT TLA WIRING FROM THROTTLE QUADRANT TO CONNECTORS P6/P7 IN ACCORDANCE WITH AMM
U/S
REPAIR AS PER AMM
OK
CONTINUE NORMAL ENGINE OPERATIONS
OK
CHECK CONTINUITY BETWEEN PINS ON CONNECTORS P1 TO J7, P4 TO J6
P1/P4 J7/J6
PIN h TO PIN E
PIN i TO PIN D
PIN H TO PIN C
PIN J TO PIN B
PIN K TO PIN A
LIMIT < 0.5Ω
OK
REPLACE EEC
U/S
REPLACE OUTER WIRING ENGINE HARNESS

FOR CHANNEL	CHECK CONNECTORS
A	P1, J7, P7
B	P4, J6, P6

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

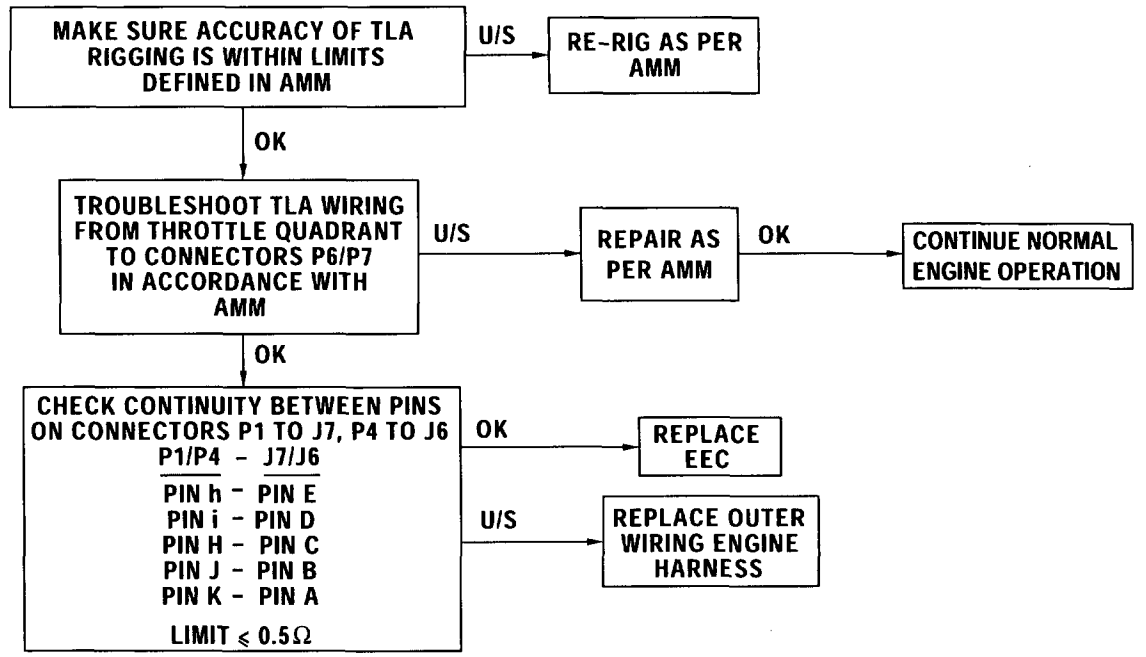
Pre-SB24434/Post-SB24514 C32928D

MFD Codes with LRU Prefix Q
Figure 115 (Sheet 1 of 5)

MFD CODE	FAULT	FAULT LEVEL
QB	TLA RATE OR RANGE	3

EFFECTS ON SYSTEM - Ⓓ THROTTLE LEVER POSITION EXCEEDS NORMAL OPERATING RATE OR RANGE
- Ⓓ TLA DEFAULTS TO IDLE POSITION.
- Ⓓ ENGINE DOES NOT RESPOND TO TLA MOVEMENT.
- Ⓓ ENGINE REMAINS AT IDLE.
- Ⓢ EEC CHANNEL SWITCHOVER.
- Ⓓ LOSS OF N1 BUG INDICATION

CORRECTIVE ACTION


MAKE SURE ACCURACY OF TLA RIGGING IS WITHIN LIMITS DEFINED IN AMM
U/S
RE-RIG AS PER AMM
OK
TROUBLESHOOT TLA WIRING FROM THROTTLE QUADRANT TO CONNECTORS P6/P7 IN ACCORDANCE WITH AMM
U/S
REPAIR AS PER AMM
OK
CONTINUE NORMAL ENGINE OPERATION
OK
CHECK CONTINUITY BETWEEN PINS ON CONNECTORS P1 TO J7, P4 TO J6
P1/P4 - J7/J6
PIN h - PIN E
PIN i - PIN D
PIN H - PIN C
PIN J - PIN B
PIN K - PIN A
LIMIT ≤ 0.5Ω
OK
REPLACE EEC
U/S
REPLACE OUTER WIRING ENGINE HARNESS

FOR CHANNEL	CHECK CONNECTORS
A	P1, J7
B	P4, J6

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

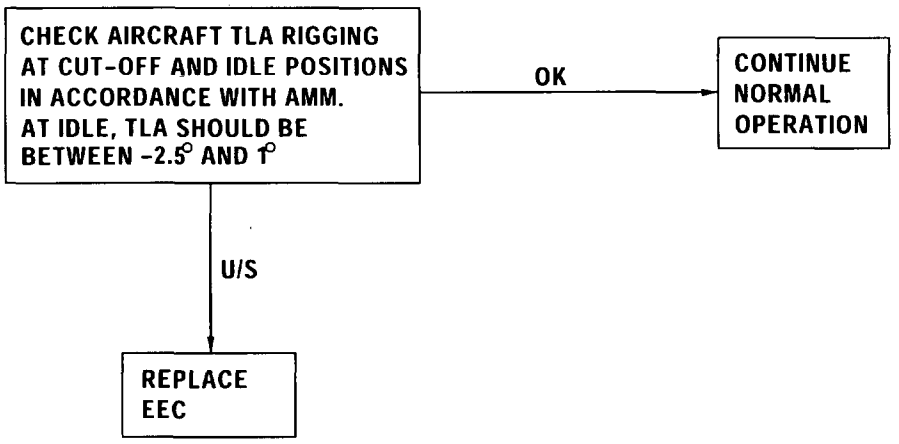
Pre-SB24434/Post-SB24514 C32929C

MFD Codes with LRU Prefix Q
Figure 115 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
QC (POST-SB24337)	TLA RIGGING OR IN-RANGE FAULT	1

EFFECTS ON SYSTEM : Ⓓ TLA DEFAULTS TO IDLE POSITION
Ⓓ ENGINE REMAINS AT IDLE

CORRECTIVE ACTION


CHECK AIRCRAFT TLA RIGGING AT CUT-OFF AND IDLE POSITIONS IN ACCORDANCE WITH AMM. AT IDLE, TLA SHOULD BE BETWEEN -2.5° AND 1°
OK
CONTINUE NORMAL OPERATION
U/S
REPLACE EEC

NOTE: FAULT CODE QC SIGNALS THAT THE TLA OR RVDT HAS DRIFTED TOWARDS CUT-OFF TO THE TLA REGION OF -2.5° TO -4°

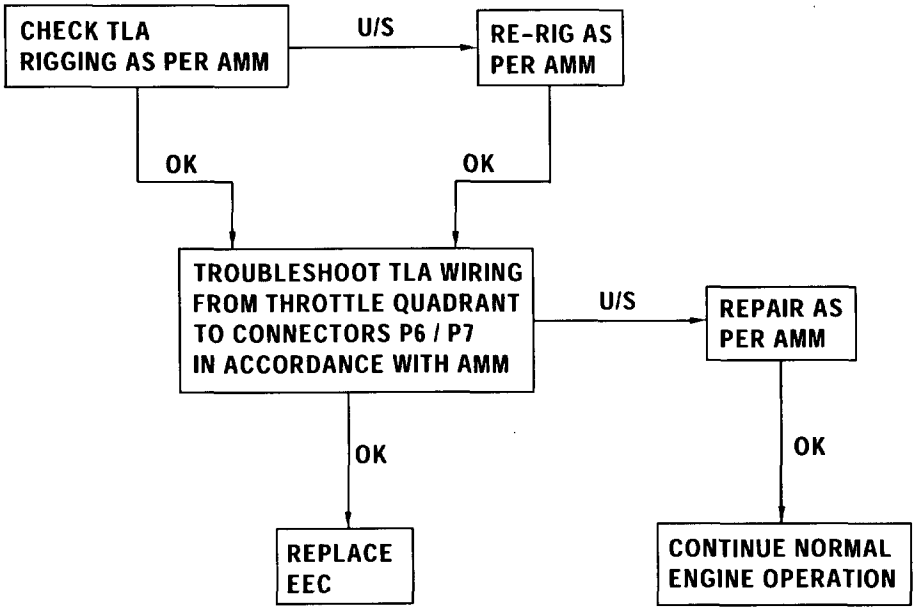
Pre-SB24434/Post-SB24514 C25660

MFD Codes with LRU Prefix Q
Figure 115 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
QD (POST-SB24337)	TLA IN CUT-OFF INCONSISTENCY	2

EFFECTS ON SYSTEM : Ⓢ NO EFFECT WHEN ENGINE IS RUNNING

CORRECTIVE ACTION



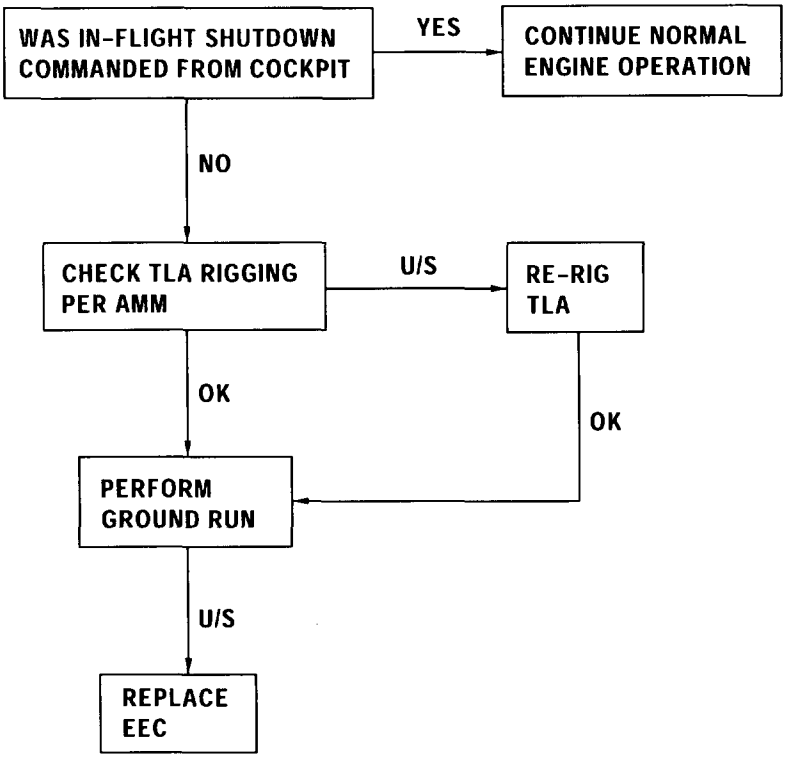
Pre-SB24434/Post-SB24514 C25661A

MFD Codes with LRU Prefix Q
Figure 115 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
QE (POST-SB24337)	COMMANDED SHUTDOWN IN AIR	0

EFFECTS ON SYSTEM : WILL RECORD MFD CODE BUT NOT AFFECT OPERATION

CORRECTIVE ACTION



Pre-SB24434/Post-SB24514 C25662

MFD Codes with LRU Prefix Q
Figure 115 (Sheet 5)

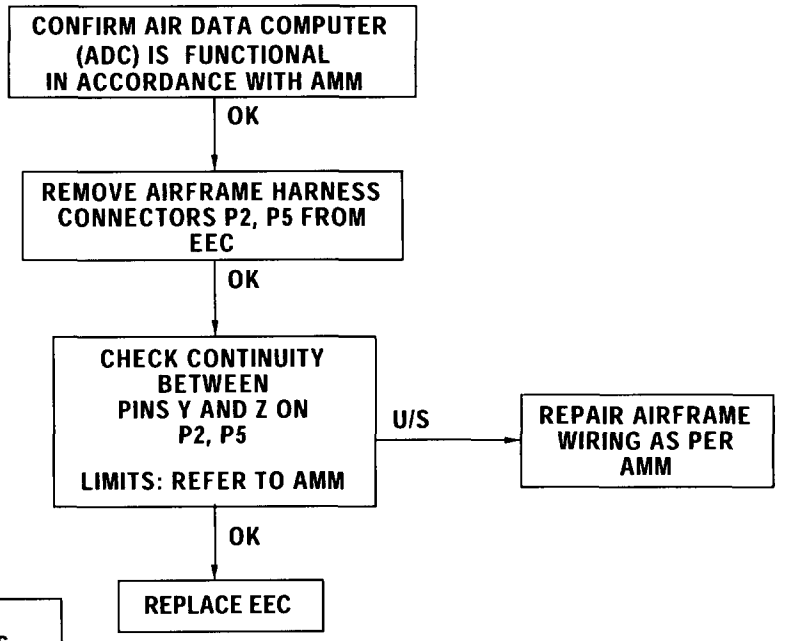
MFD CODE	FAULT	FAULT LEVEL	
RA	ARINC RECEIVE	0	PW305A ONLY 1

EFFECTS ON SYSTEM -(D) FAULT WILL NOT DEGRADE OPERABILITY OF EEC CHANNEL BECAUSE LOSS OF ADC Pt AND Pamb WILL SELECT ENGINE SUPPLIED Pt AND Pamb.

-(D) LOSS OF ADC TTO WILL REMOVE THE AVAILABILITY OF ENGINE TTO BACKUP.

-(S) LANE CHANGE ON PW305A

CORRECTIVE ACTION


CONFIRM AIR DATA COMPUTER (ADC) IS FUNCTIONAL IN ACCORDANCE WITH AMM
OK
REMOVE AIRFRAME HARNESS CONNECTORS P2, P5 FROM EEC
OK
CHECK CONTINUITY BETWEEN PINS Y AND Z ON P2, P5
LIMITS: REFER TO AMM
U/S
REPAIR AIRFRAME WIRING AS PER AMM
OK
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: (S) = SINGLE CHANNEL FAULT
(D) = DUAL CHANNEL FAULT

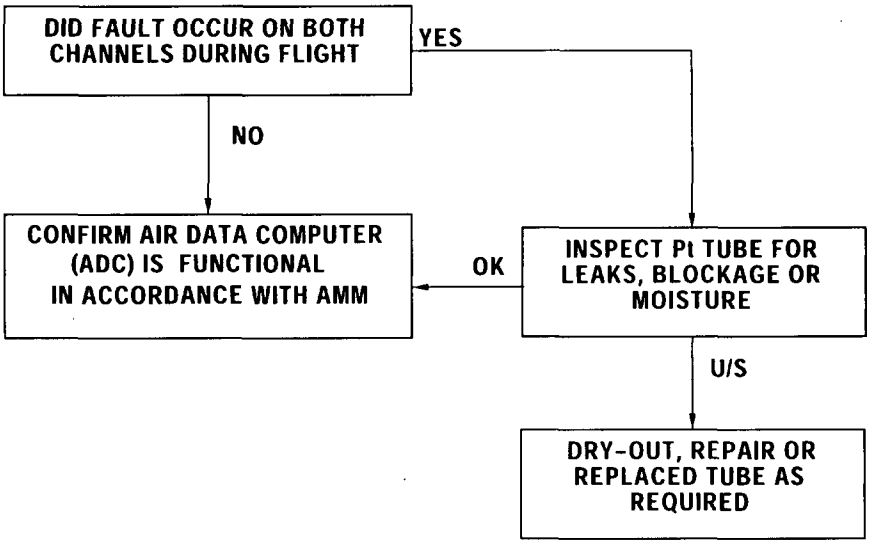
Pre-SB24434/Post-SB24514 C32930D

MFD Codes with LRU Prefix R
Figure 116 (Sheet 1 of 3)

MFD CODE	FAULT	FAULT LEVEL	
RB	ADC Pt, RANGE FAIL OR IN RANGE COPARISON FAIL	PW305B 0	PW305A 1

EFFECTS ON SYSTEM -(D) FAULT WILL NOT DEGRADE OPERABILITY OF EEC CHANNEL BECAUSE LOSS OF ADC Pt WILL SELECT ENGINE SUPPLIED Pt.
-(D) LOSS OF N1 BUG INDICATION IF MFD CODES RB AND HB OCCUR TOGETHER
-(D) LANE CHANGE OCCURS (PRE SB-24434 / POST-SB24514)

CORRECTIVE ACTION


DID FAULT OCCUR ON BOTH CHANNELS DURING FLIGHT
YES
NO
CONFIRM AIR DATA COMPUTER (ADC) IS FUNCTIONAL IN ACCORDANCE WITH AMM
OK
INSPECT Pt TUBE FOR LEAKS, BLOCKAGE OR MOISTURE
U/S
DRY-OUT, REPAIR OR REPLACED TUBE AS REQUIRED

NOTE: (D) = DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C24686B

MFD Codes with LRU Prefix R
Figure 116 (Sheet 2)

NOTE:

Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

MFD CODE	FAULT	FAULT LEVEL	
		PW305B	PW305A
RC	ADC Pamb, RANGE FAIL OR IN RANGE COMPARISON FAIL	0	1
RD	ADC TTO, RANGE FAIL OR IN RANGE COMPARISON FAIL	0	1

EFFECTS ON SYSTEM : RC - Ⓓ FAULT WILL NOT DEGRADE OPERABILITY OF EEC CHANNEL.
- Ⓢ LOSS OF N1 BUG INDICATION IF MFD CODES RC AND JB OCCUR TOGETHER
- Ⓢ LOSS OF ADC Pamb WILL SELECT ENGINE SUPPLIED Pamb.
- Ⓢ LANE CHANGE OCCURS (PW305A PRE-SB24434/POST-SB24514 ONLY)

RD - Ⓓ FAULT MAY DEGRADE OPERABILITY OF EEC CHANNEL..
- Ⓢ LOSS OF N1 BUG INDICATION IF MFD CODES RD AND KB OCCUR TOGETHER
- Ⓢ LOSS OF ADC Pamb WILL SELECT ENGINE SUPPLIED Pamb.
- Ⓢ LOSS OF ADC TTO WILL SELECT THE DEFAULT TTO, IF THE ENGINE TTO HAS FAILED PRIOR TO ADC TTO.

CORRECTIVE ACTION

CONFIRM AIR DATA COMPUTER (ADC) IS FUNCTIONAL IN ACCORDANCE WITH AMM

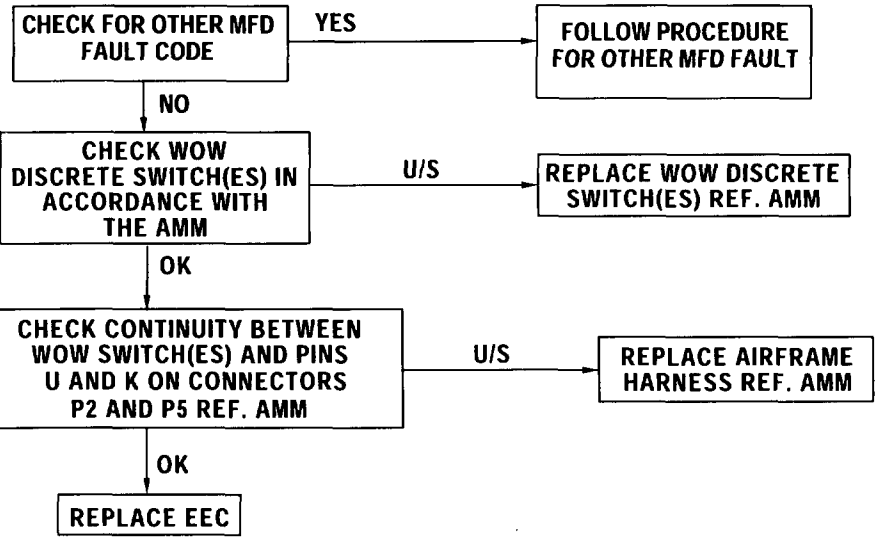
Pre-SB24434/Post-SB24514 C32932D

MFD Codes with LRU Prefix R
Figure 116 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
SA	WOW DISCRETE CHECK	2

EFFECTS ON SYSTEM - FAULT INDICATES AIR DATA COMPUTER AIRSPEED IS:
- LESS THAN 50 KNOTS WITH A/C IN FLIGHT (WOWF = 0)
OR
- GREATER THAN 330 KNOTS WITH A/C ON THE GROUND (WOWF = 1)
- (D) IMPROPER FLIGHT LEG FAULT RECORDING
- (D) NO THRUST REVERSER OPERATION
- (D) NO ABORT START CAPABILITY
- (D) ENGINE RUNNING TO FLIGHT IDLE SPEED WHEN AIRCRAFT IS ON GROUND
- (D) LONG START TIMES
- (S) EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION


CHECK FOR OTHER MFD FAULT CODE
YES
FOLLOW PROCEDURE FOR OTHER MFD FAULT
NO
CHECK WOW DISCRETE SWITCH(ES) IN ACCORDANCE WITH THE AMM
U/S
REPLACE WOW DISCRETE SWITCH(ES) REF. AMM
OK
CHECK CONTINUITY BETWEEN WOW SWITCH(ES) AND PINS U AND K ON CONNECTORS P2 AND P5 REF. AMM
U/S
REPLACE AIRFRAME HARNESS REF. AMM
OK
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: (S) = SINGLE CHANNEL FAULT
(D) = DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 (PW305B only) C28303B

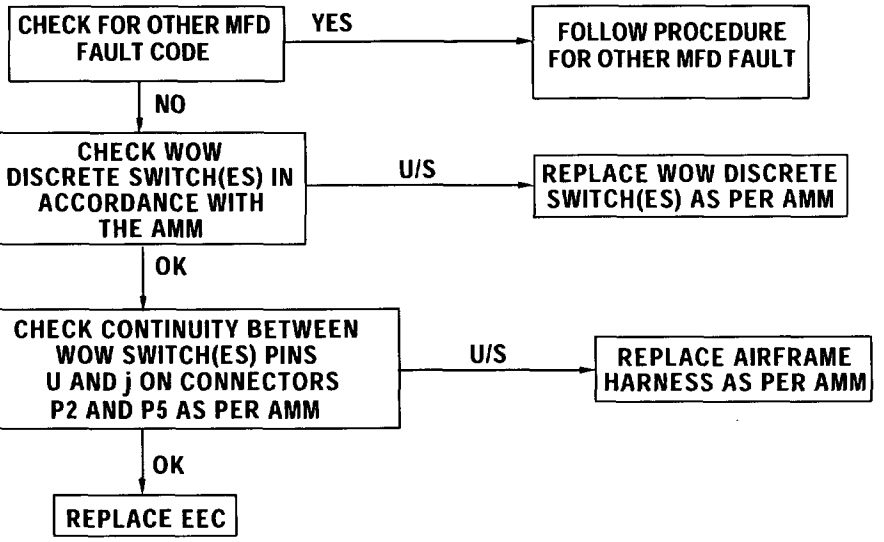
MFD Codes with LRU Prefix S
Figure 117 (Sheet 1 of 2)

MFD CODE	FAULT	FAULT LEVEL
SA	WOW DISCRETE CHECK	2

EFFECTS ON SYSTEM - FAULT INDICATES AIR DATA COMPUTER AIRSPEED IS:
- LESS THAN 50 KNOTS WITH A/C IN FLIGHT (WOWF = 0)
OR
- GREATER THAN 330 KNOTS WITH A/C ON THE GROUND (WOWF = 1)

- (D) IMPROPER FLIGHT LEG FAULT RECORDING
- (D) NO THRUST REVERSER OPERATION
- (D) NO ABORT START CAPABILITY
- (D) ENGINE RUNNING TO FLIGHT IDLE SPEED WHEN AIRCRAFT IS ON GROUND
- (D) LONG START TIMES
- (S) EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION


CHECK FOR OTHER MFD FAULT CODE
YES
FOLLOW PROCEDURE FOR OTHER MFD FAULT
NO
CHECK WOW DISCRETE SWITCH(ES) IN ACCORDANCE WITH THE AMM
U/S
REPLACE WOW DISCRETE SWITCH(ES) AS PER AMM
OK
CHECK CONTINUITY BETWEEN WOW SWITCH(ES) PINS U AND j ON CONNECTORS P2 AND P5 AS PER AMM
U/S
REPLACE AIRFRAME HARNESS AS PER AMM
OK
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: (S) = SINGLE CHANNEL FAULT
(D) = DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 (PW305A only) C28303A

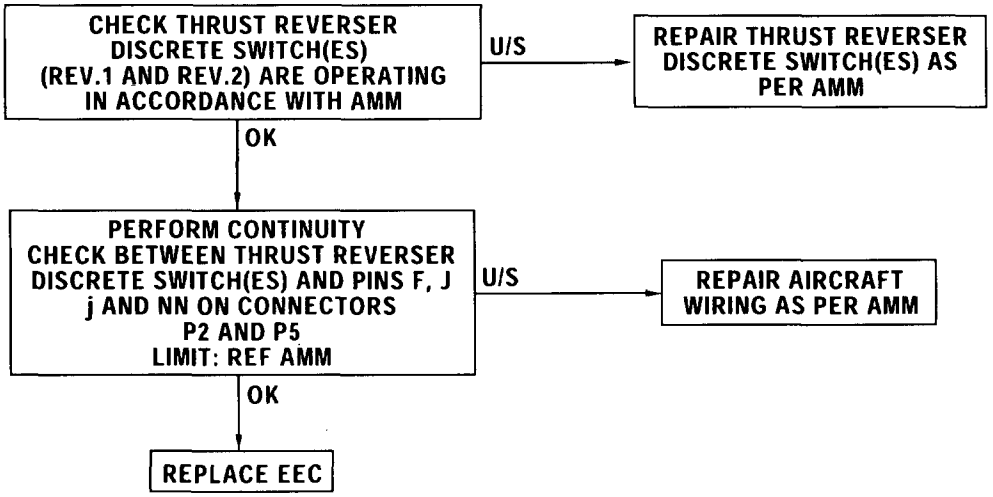
MFD Codes with LRU Prefix S
Figure 117 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
TA	THRUST REVERSER DISCRETES SEQUENCE CHECK	3
TB	THRUST REVERSER SPURIOUS DISCRETE	2

EFFECTS ON SYSTEM : **TA** - Ⓓ ENGINE SPEED DROPS TO IDLE
- Ⓢ EEC CHANNEL SWITCHOVER

TB - Ⓓ INHIBITS THRUST REVERSER THROTTLE LEVER SCHEDULE
- Ⓢ EEC CHANNEL SWITCHOVER
- Ⓓ NO SYSTEM DEGRADATION. FORWARD THRUST SCHEDULE MAINTAINED
- Ⓢ FAULT RESETTABLE BY STOWING THRUST REVERSER

CORRECTIVE ACTION


CHECK THRUST REVERSER DISCRETE SWITCH(ES) (REV.1 AND REV.2) ARE OPERATING IN ACCORDANCE WITH AMM
U/S
REPAIR THRUST REVERSER DISCRETE SWITCH(ES) AS PER AMM
OK
PERFORM CONTINUITY CHECK BETWEEN THRUST REVERSER DISCRETE SWITCH(ES) AND PINS F, J j AND NN ON CONNECTORS P2 AND P5 LIMIT: REF AMM
U/S
REPAIR AIRCRAFT WIRING AS PER AMM
OK
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ = SINGLE CHANNEL FAULT
Ⓓ = DUAL CHANNEL FAULT

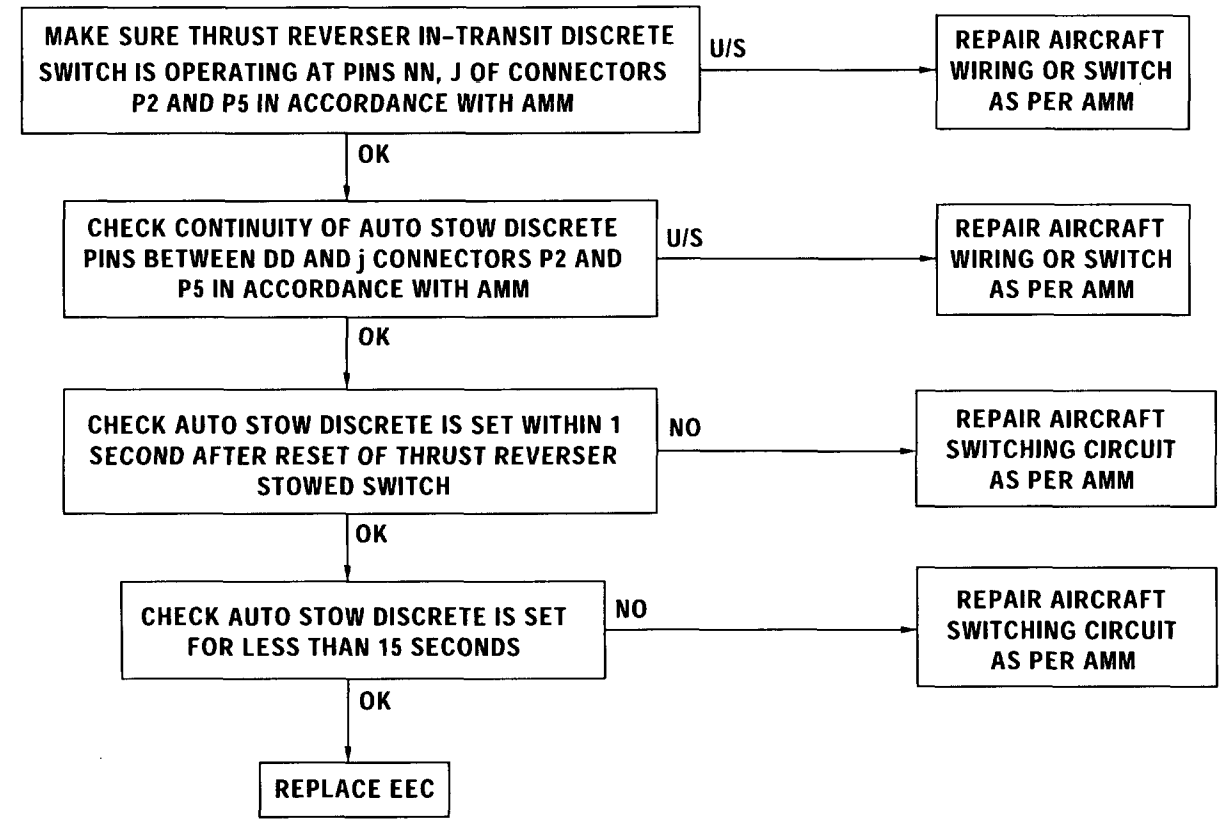
Pre-SB24434/Post-SB24514 C32936C

MFD Codes with LRU Prefix T
Figure 118 (Sheet 1 of 3)

MFD CODE	FAULT	FAULT LEVEL
TC	AUTO STOW DISCRETE INPUT FAULT	1

EFFECTS ON SYSTEM - CAN NOT CLEAR T/R SEQUENCE FAULT

CORRECTIVE ACTION


MAKE SURE THRUST REVERSER IN-TRANSIT DISCRETE SWITCH IS OPERATING AT PINS NN, J OF CONNECTORS P2 AND P5 IN ACCORDANCE WITH AMM
U/S
REPAIR AIRCRAFT WIRING OR SWITCH AS PER AMM
OK
CHECK CONTINUITY OF AUTO STOW DISCRETE PINS BETWEEN DD AND j CONNECTORS P2 AND P5 IN ACCORDANCE WITH AMM
U/S
REPAIR AIRCRAFT WIRING OR SWITCH AS PER AMM
OK
CHECK AUTO STOW DISCRETE IS SET WITHIN 1 SECOND AFTER RESET OF THRUST REVERSER STOWED SWITCH
NO
REPAIR AIRCRAFT SWITCHING CIRCUIT AS PER AMM
OK
CHECK AUTO STOW DISCRETE IS SET FOR LESS THAN 15 SECONDS
NO
REPAIR AIRCRAFT SWITCHING CIRCUIT AS PER AMM
OK
REPLACE EEC

FOR CHANNEL	CHECK CONNECTOR(S)
A	P2
B	P5

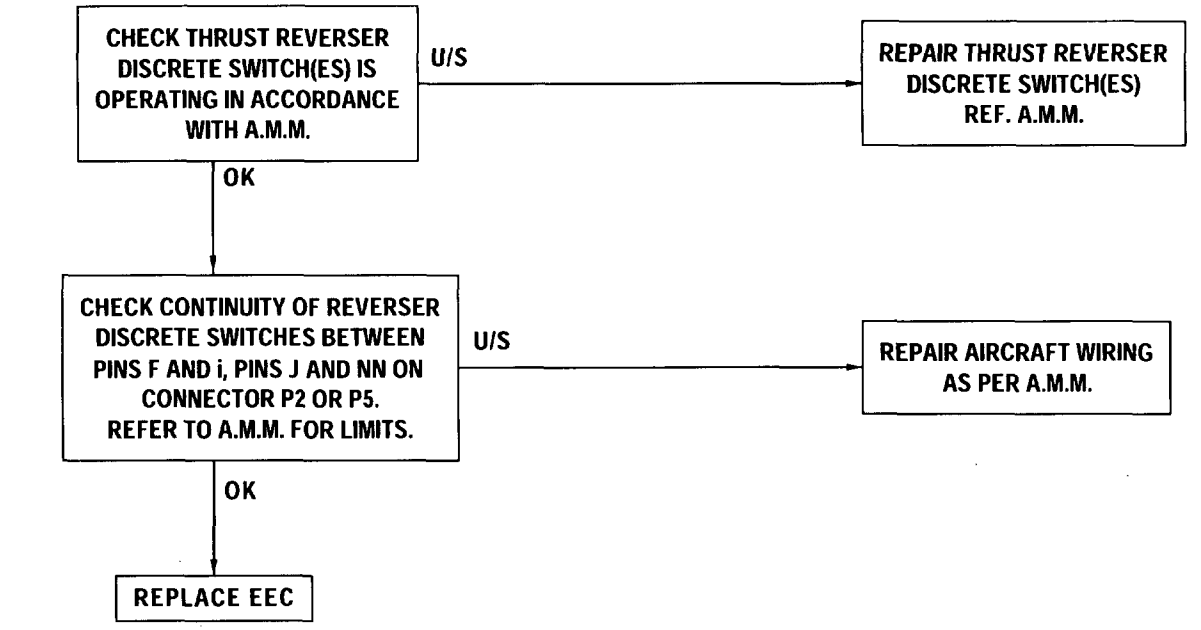
Pre-SB24434/Post-SB24514 C33377B

MFD Codes with LRU Prefix T
Figure 118 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
TD	THRUST REVERSER DISCRETE FAULT	3
TE	T/R IN TRANSIT FAULT ON POWER UP	2

EFFECTS ON SYSTEM: TD -(D) ENGINE SPEED SET TO IDLE REGARDLESS OF TLA POSITION.
-(S) LANE CHANGE
TE -(D) ENGINE SPEED LIMITED AT IDLE WHEN IN TRANSIT DISCRETE SET.
-(S) LANE CHANGE

CORRECTIVE ACTION


CHECK THRUST REVERSER DISCRETE SWITCH(ES) IS OPERATING IN ACCORDANCE WITH A.M.M.
U/S
REPAIR THRUST REVERSER DISCRETE SWITCH(ES) REF. A.M.M.
OK
CHECK CONTINUITY OF REVERSER DISCRETE SWITCHES BETWEEN PINS F AND i, PINS J AND NN ON CONNECTOR P2 OR P5. REFER TO A.M.M. FOR LIMITS.
U/S
REPAIR AIRCRAFT WIRING AS PER A.M.M.
OK
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: (S) = SINGLE CHANNEL FAULT
(D) = DUAL CHANNEL FAULT

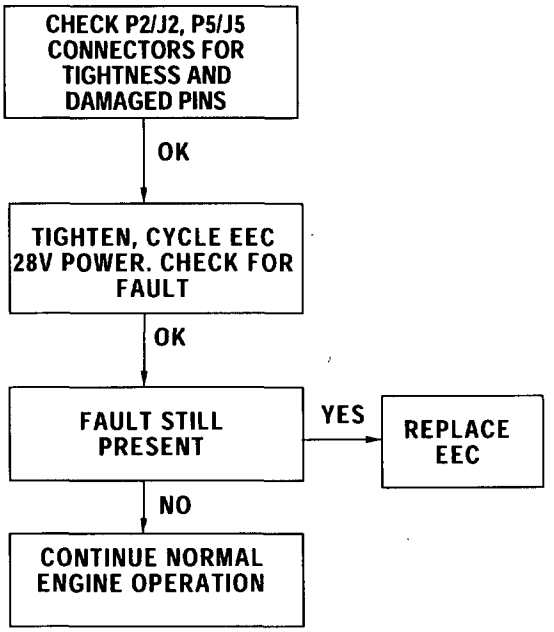
Pre-SB24434/Post-SB24514 C32975C

MFD Codes with LRU Prefix T
Figure 118 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
UG	ATTCS ACHIEVED BITE FAULT	SEE FAULT CODE 2D
UH	ATTCS ARMED BITE FAULT	SEE FAULT CODE 2D
UJ	SOFT FAIL 1 BITE FAULT	SEE FAULT CODE 2D
UK	SOFT FAIL 2 BITE FAULT	SEE FAULT CODE 2D
UL	IGNITION DRIVE BITE FAULT	SEE FAULT CODE 2D

EFFECTS ON SYSTEM
UG, UH - LOSS OF APR LAMP INDICATION
UK - SOFT FAIL 2 FAULT LAMP INDICATION ALWAYS ON
UJ - SOFT FAIL 1 FAULT LAMP INDICATION ALWAYS ON
UL - LOSS OF EEC IGNITOR CONTROL

CORRECTIVE ACTION



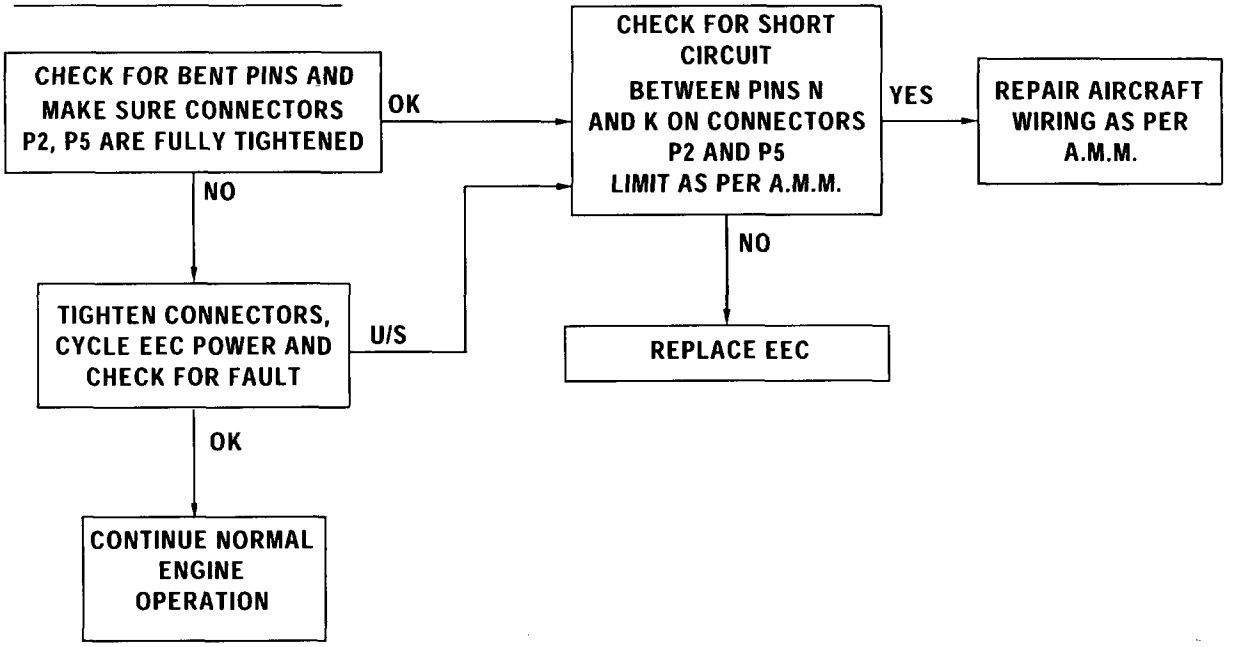
Pre-SB24434/Post-SB24514 C33563C

MFD Codes with LRU Prefix U
Figure 119

MFD CODE	FAULT	FAULT LEVEL
VA (PW305A ONLY)	EXTERNAL RESET DISCRETE INPUT FAULT	1

EFFECTS ON SYSTEM: - DISABLES EXTERNAL RESET FUNCTION

CORRECTIVE ACTION


CHECK FOR BENT PINS AND MAKE SURE CONNECTORS P2, P5 ARE FULLY TIGHTENED
OK
CHECK FOR SHORT CIRCUIT BETWEEN PINS N AND K ON CONNECTORS P2 AND P5 LIMIT AS PER A.M.M.
YES
REPAIR AIRCRAFT WIRING AS PER A.M.M.
NO
TIGHTEN CONNECTORS, CYCLE EEC POWER AND CHECK FOR FAULT
U/S
NO
REPLACE EEC
OK
CONTINUE NORMAL ENGINE OPERATION

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

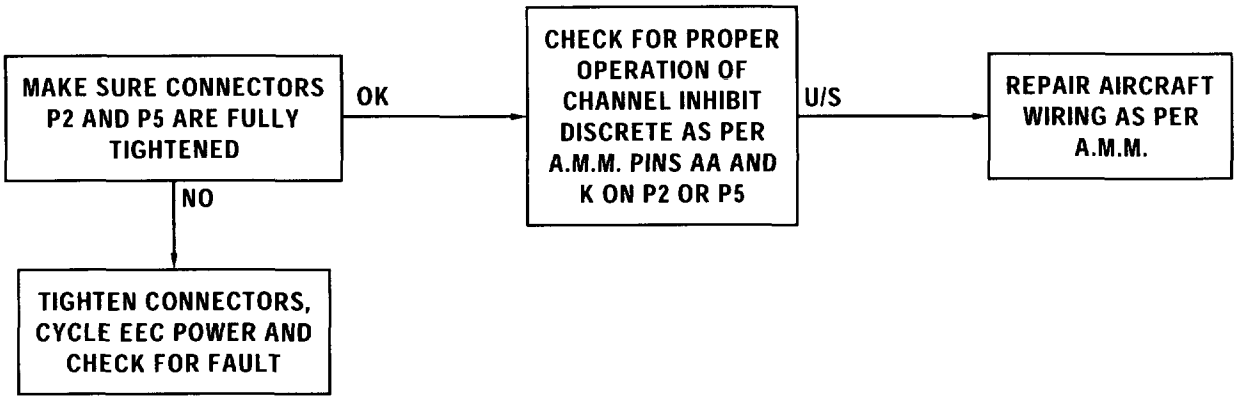
Pre-SB24434/Post-SB24514 C33822A

MFD Codes with LRU Prefix V
Figure 120 (Sheet 1 of 6)

MFD CODE	FAULT	FAULT LEVEL
VB (PW305A ONLY)	CHANNEL INHIBIT DISCRETE INPUT FAULT	1

EFFECTS ON SYSTEM: - CHANNEL INHIBIT DISCRETE IS DISABLED

CORRECTIVE ACTION


MAKE SURE CONNECTORS P2 AND P5 ARE FULLY TIGHTENED
OK
CHECK FOR PROPER OPERATION OF CHANNEL INHIBIT DISCRETE AS PER A.M.M. PINS AA AND K ON P2 OR P5
U/S
REPAIR AIRCRAFT WIRING AS PER A.M.M.
NO
TIGHTEN CONNECTORS, CYCLE EEC POWER AND CHECK FOR FAULT

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

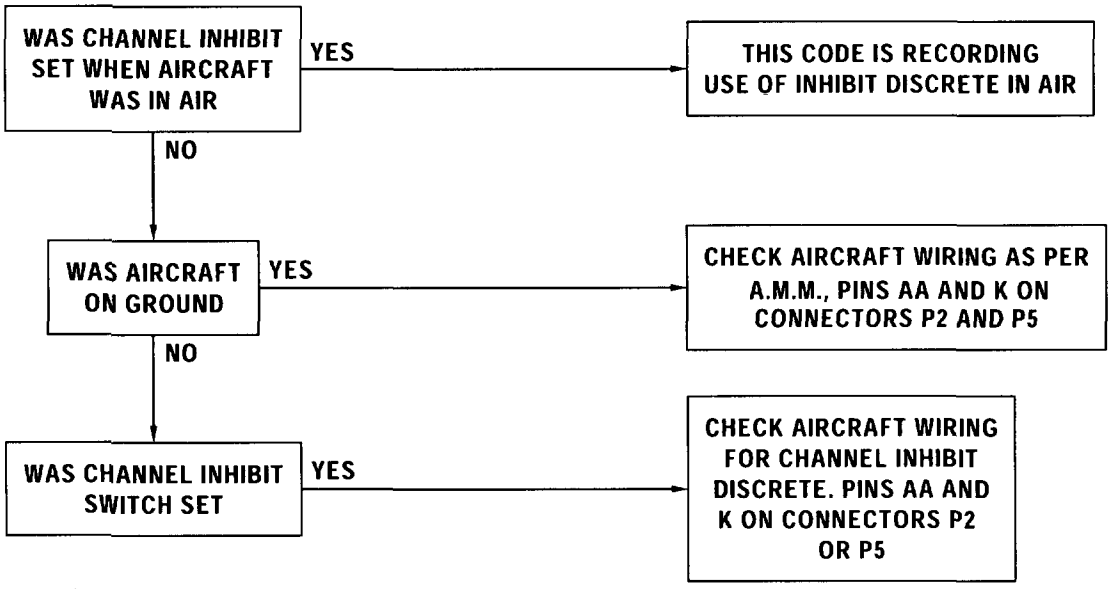
Pre-SB24434/Post-SB24514 C33823

MFD Codes with LRU Prefix V
Figure 120 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
VC (PW305A ONLY)	CHANNEL INHIBITED IN AIR	0

EFFECTS ON SYSTEM: - WILL RECORD MFD CODE BUT NOT AFFECT OPERATION

CORRECTIVE ACTION


WAS CHANNEL INHIBIT SET WHEN AIRCRAFT WAS IN AIR
YES
THIS CODE IS RECORDING USE OF INHIBIT DISCRETE IN AIR
NO
WAS AIRCRAFT ON GROUND
YES
CHECK AIRCRAFT WIRING AS PER A.M.M., PINS AA AND K ON CONNECTORS P2 AND P5
NO
WAS CHANNEL INHIBIT SWITCH SET
YES
CHECK AIRCRAFT WIRING FOR CHANNEL INHIBIT DISCRETE. PINS AA AND K ON CONNECTORS P2 OR P5

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

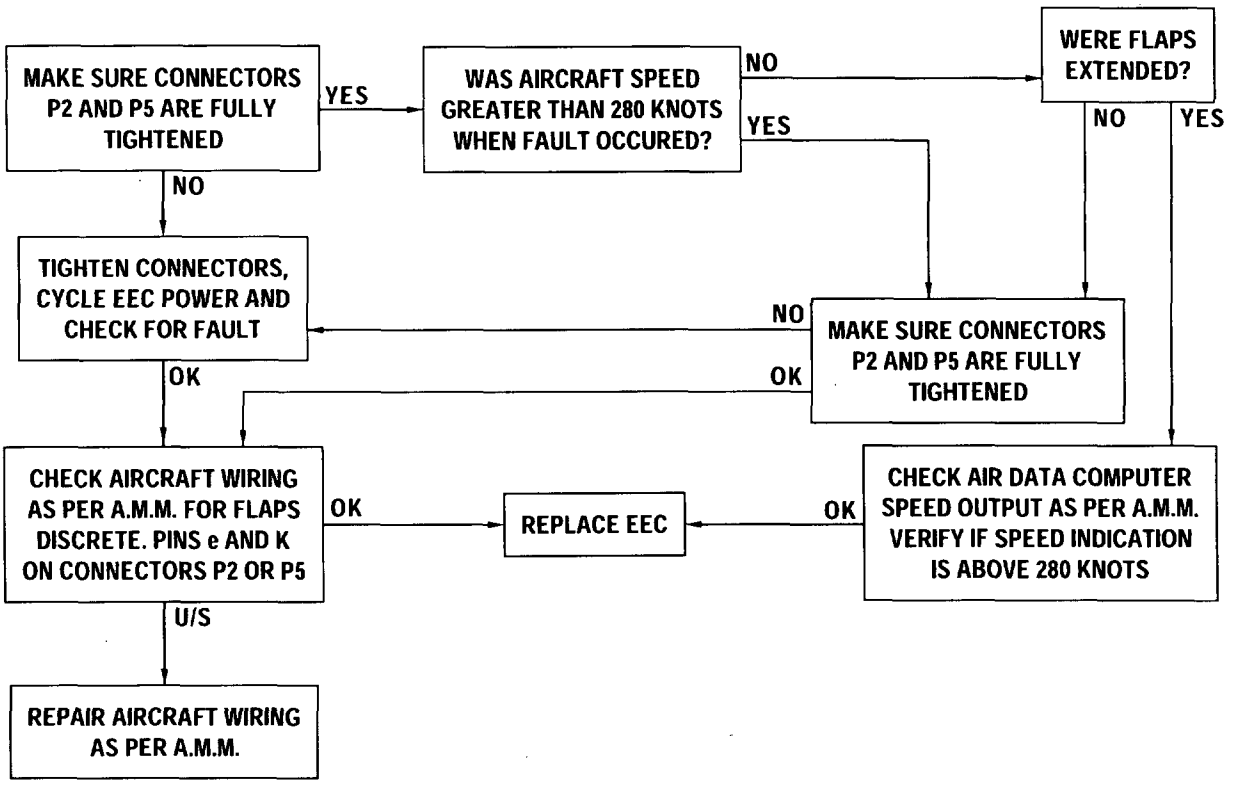
Pre-SB24434/Post-SB24514 C33824A

MFD Codes with LRU Prefix V
Figure 120 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
VD (PW305A ONLY)	FLAP DISCRETE INPUT FAULT	1

EFFECTS ON SYSTEM : - Ⓓ N1 BUG INDICATION - INSTEAD OF INDICATING THE TAKEOFF RATING DURING APPROACH, N1 BUG WILL INDICATE THE NEXT HIGHER DETENTE RATING

CORRECTIVE ACTION


MAKE SURE CONNECTORS P2 AND P5 ARE FULLY TIGHTENED
YES
WAS AIRCRAFT SPEED GREATER THAN 280 KNOTS WHEN FAULT OCCURED?
NO
YES
WERE FLAPS EXTENDED?
NO
YES
NO
TIGHTEN CONNECTORS, CYCLE EEC POWER AND CHECK FOR FAULT
NO
MAKE SURE CONNECTORS P2 AND P5 ARE FULLY TIGHTENED
OK
OK
CHECK AIRCRAFT WIRING AS PER A.M.M. FOR FLAPS DISCRETE. PINS e AND K ON CONNECTORS P2 OR P5
OK
REPLACE EEC
OK
CHECK AIR DATA COMPUTER SPEED OUTPUT AS PER A.M.M. VERIFY IF SPEED INDICATION IS ABOVE 280 KNOTS
U/S
REPAIR AIRCRAFT WIRING AS PER A.M.M.

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓓ = DUAL CHANNEL FAULT

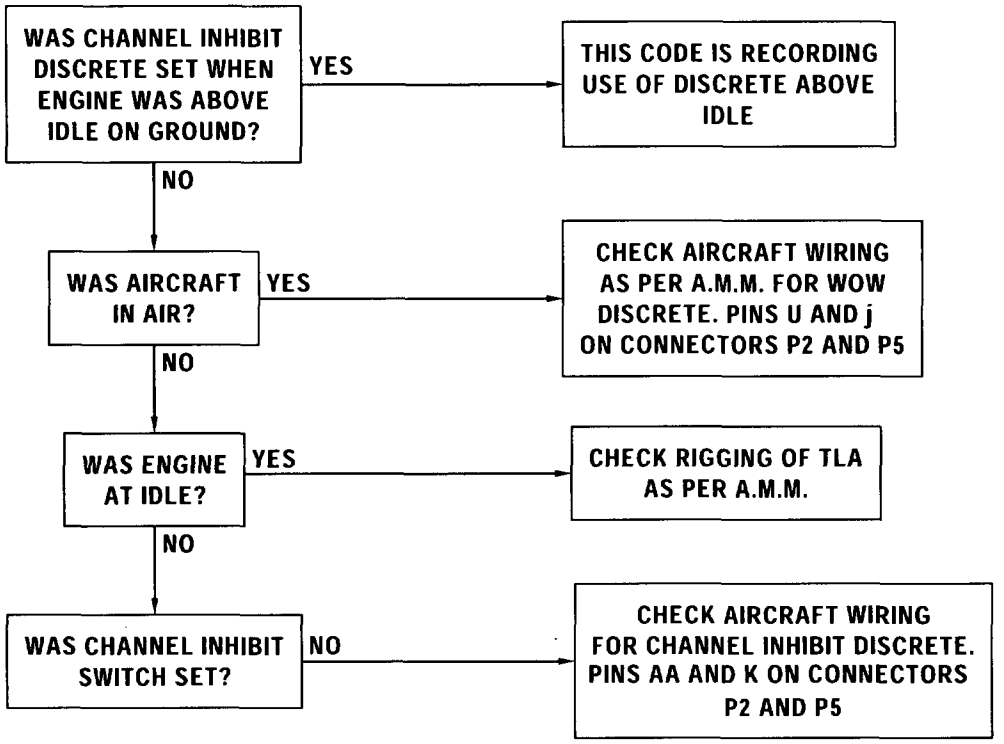
Pre-SB24434/Post-SB24514 C33826A

MFD Codes with LRU Prefix V
Figure 120 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
VE (PW305A ONLY)	USE OF CHANNEL INHIBIT ON GROUND	2

EFFECTS ON SYSTEM: - EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION


WAS CHANNEL INHIBIT DISCRETE SET WHEN ENGINE WAS ABOVE IDLE ON GROUND?
YES
THIS CODE IS RECORDING USE OF DISCRETE ABOVE IDLE
NO
WAS AIRCRAFT IN AIR?
YES
CHECK AIRCRAFT WIRING AS PER A.M.M. FOR WOW DISCRETE. PINS U AND j ON CONNECTORS P2 AND P5
NO
WAS ENGINE AT IDLE?
YES
CHECK RIGGING OF TLA AS PER A.M.M.
NO
WAS CHANNEL INHIBIT SWITCH SET?
NO
CHECK AIRCRAFT WIRING FOR CHANNEL INHIBIT DISCRETE. PINS AA AND K ON CONNECTORS P2 AND P5

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

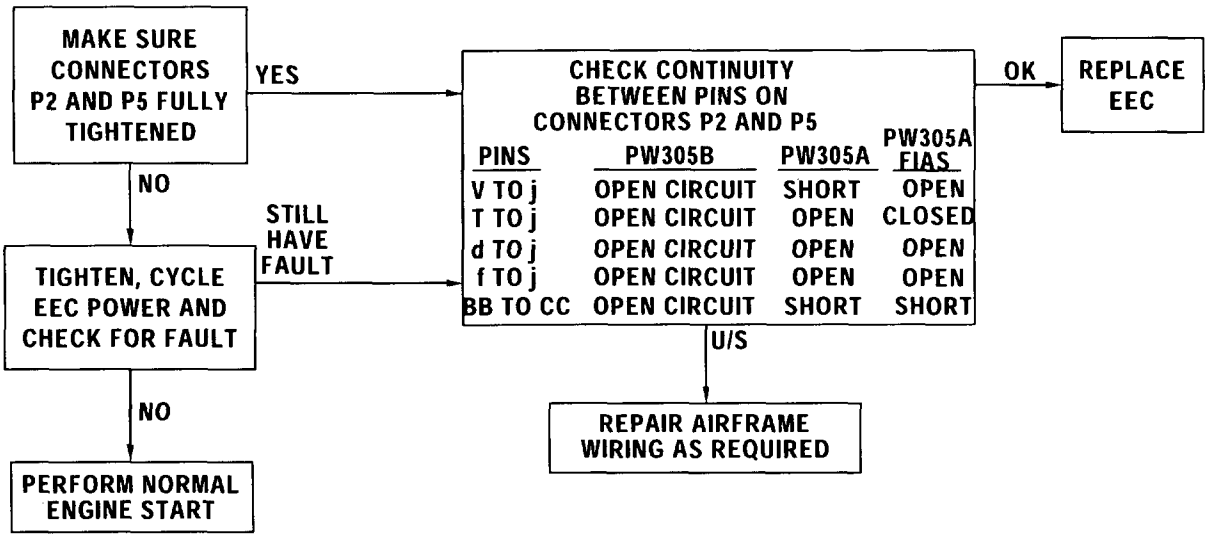
Pre-SB24434/Post-SB24514 C33825A

MFD Codes with LRU Prefix V
Figure 120 (Sheet 5)

MFD CODE	FAULT	FAULT LEVEL	
VF	AIRCRAFT IDENTIFICATION FAULT	3	PW305A ONLY 2

EFFECTS ON SYSTEM - SOFTWARE AND AIRCRAFT INCOMPATIBLE

CORRECTIVE ACTION


MAKE SURE CONNECTORS P2 AND P5 FULLY TIGHTENED
YES
NO
TIGHTEN, CYCLE EEC POWER AND CHECK FOR FAULT
STILL HAVE FAULT
NO
PERFORM NORMAL ENGINE START
CHECK CONTINUITY BETWEEN PINS ON CONNECTORS P2 AND P5
PINS PW305B PW305A PW305A FIAS
V TO j OPEN CIRCUIT SHORT OPEN
T TO j OPEN CIRCUIT OPEN CLOSED
d TO j OPEN CIRCUIT OPEN OPEN
f TO j OPEN CIRCUIT OPEN OPEN
BB TO CC OPEN CIRCUIT SHORT SHORT
OK
REPLACE EEC
U/S
REPAIR AIRFRAME WIRING AS REQUIRED

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

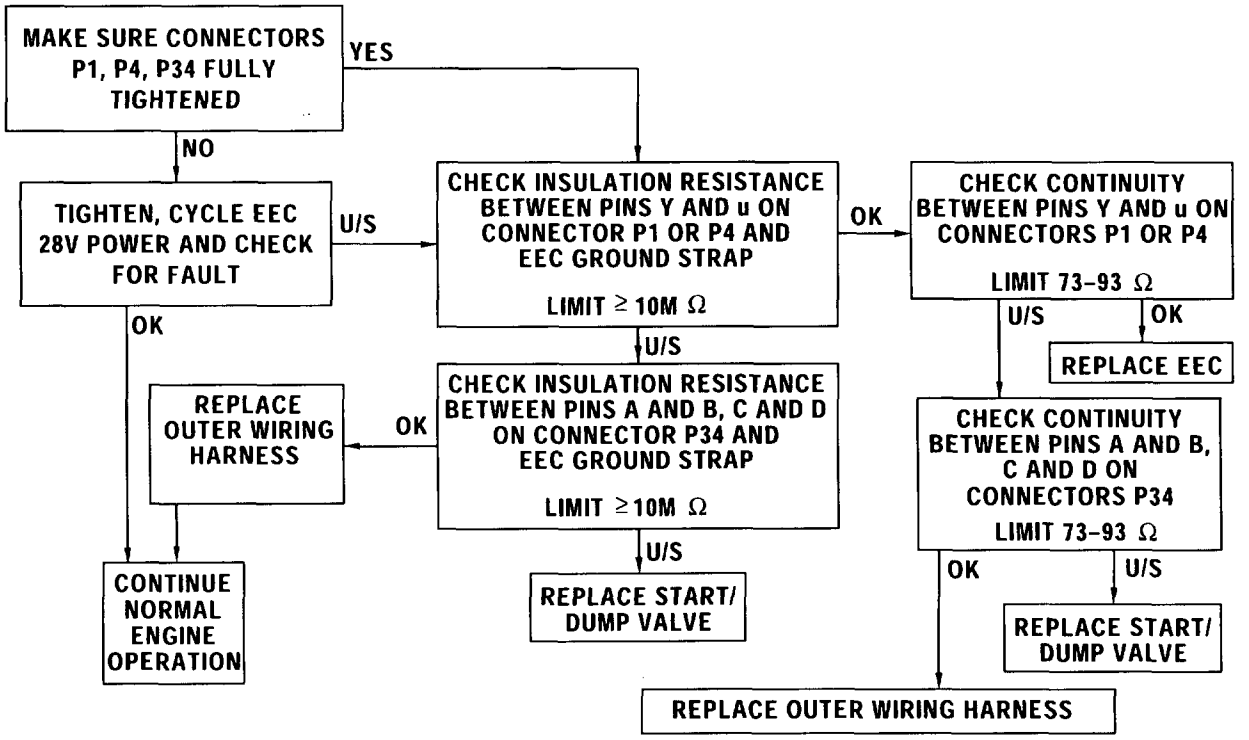
Pre-SB24434/Post-SB24514 C33164D

MFD Codes with LRU Prefix V
Figure 120 (Sheet 6)

MFD CODE	FAULT	FAULT LEVEL
WA	START VALVE DRIVE EXTERNAL OPEN CIRCUIT	1
WB	START VALVE DRIVE INTERNAL OPEN CIRCUIT	1
WC	START VALVE DRIVE EXTERNAL SHORT CIRCUIT	1

EFFECTS ON SYSTEM - Ⓓ GROUND STARTS LONGER AND COOLER THAN NORMAL.
NO IMPACT ON AIR STARTS.
- Ⓢ CHANNEL SWITCHOVER.

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P34 FULLY TIGHTENED
YES
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CHECK INSULATION RESISTANCE BETWEEN PINS Y AND u ON CONNECTOR P1 OR P4 AND EEC GROUND STRAP
LIMIT ≥ 10M Ω
OK
CHECK CONTINUITY BETWEEN PINS Y AND u ON CONNECTORS P1 OR P4
LIMIT 73-93 Ω
U/S
OK
REPLACE EEC
U/S
CHECK INSULATION RESISTANCE BETWEEN PINS A AND B, C AND D ON CONNECTOR P34 AND EEC GROUND STRAP
LIMIT ≥10M Ω
OK
REPLACE OUTER WIRING HARNESS
CHECK CONTINUITY BETWEEN PINS A AND B, C AND D ON CONNECTORS P34
LIMIT 73-93 Ω
OK
U/S
U/S
REPLACE START/ DUMP VALVE
REPLACE START/ DUMP VALVE
CONTINUE NORMAL ENGINE OPERATION
REPLACE OUTER WIRING HARNESS

NOTE: START VALVE IS BASIC ON PW305A AND POST-SB24156 ON PW305 / PW305B

FOR CHANNEL	CHECK CONNECTORS
A	P1, P34
B	P4, P34

NOTE: Ⓢ = SINGLE CHANNEL FAULT
Ⓓ = DUAL CHANNEL FAULT

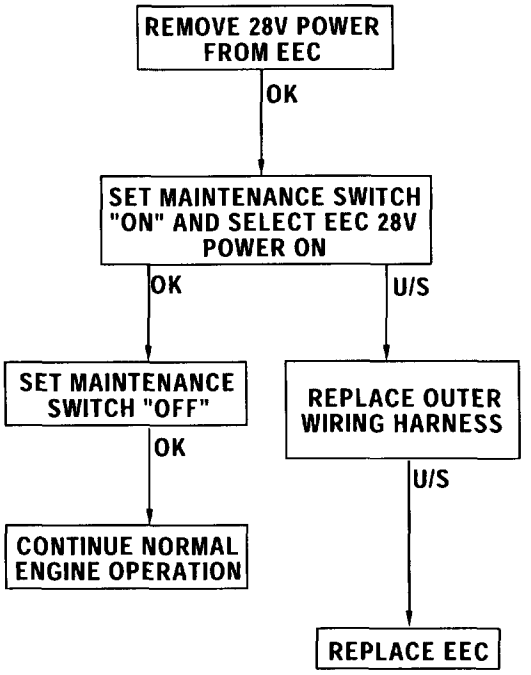
Pre-SB24434/Post-SB24514 C32944C

MFD Codes with LRU Prefix W
Figure 121 (Sheet 1 of 4)

MFD CODE	FAULT	FAULT LEVEL
WD	START VALVE NOT FITTED BUT DETECTED	1

EFFECTS ON SYSTEM - (D) GROUND STARTS LONGER AND COOLER THAN NORMAL.
NO IMPACT ON AIR STARTS.
- (S) CHANNEL SWITCHOVER.

CORRECTIVE ACTION



NOTE: (S) = SINGLE CHANNEL FAULT
(D) = DUAL CHANNEL FAULT

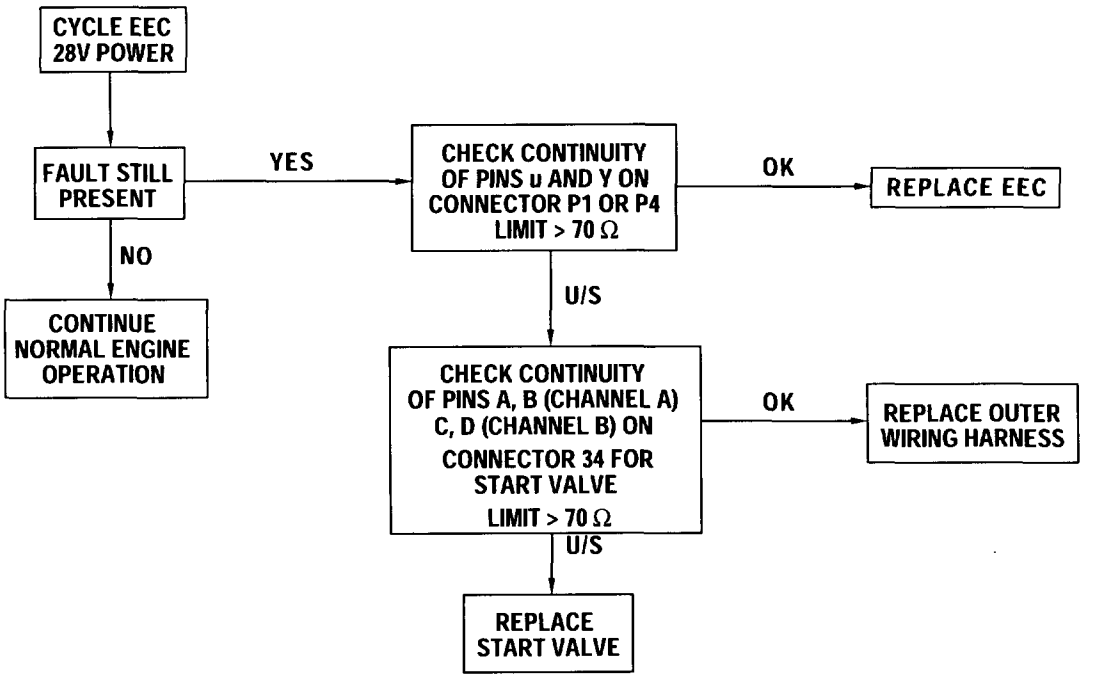
Pre-SB24434/Post-SB24514 C32947B

MFD Codes with LRU Prefix W
Figure 121 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
WE	START VALVE DRIVER FAULT	SEE FAULT CODE 2D

EFFECTS ON SYSTEM -Ⓢ EEC CHANNEL SWITCHOVER
-Ⓓ LOSS OF START VALVE CONTROL

CORRECTIVE ACTION


CYCLE EEC 28V POWER
FAULT STILL PRESENT
YES
NO
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY OF PINS u AND Y ON CONNECTOR P1 OR P4 LIMIT > 70 Ω
OK
REPLACE EEC
U/S
CHECK CONTINUITY OF PINS A, B (CHANNEL A) C, D (CHANNEL B) ON CONNECTOR 34 FOR START VALVE LIMIT > 70 Ω
OK
REPLACE OUTER WIRING HARNESS
U/S
REPLACE START VALVE

FOR CHANNEL	CHECK CONNECTORS
A	P1
B	P4

NOTE: Ⓢ = SINGLE CHANNEL FAULT
Ⓓ = DUAL CHANNEL FAULT

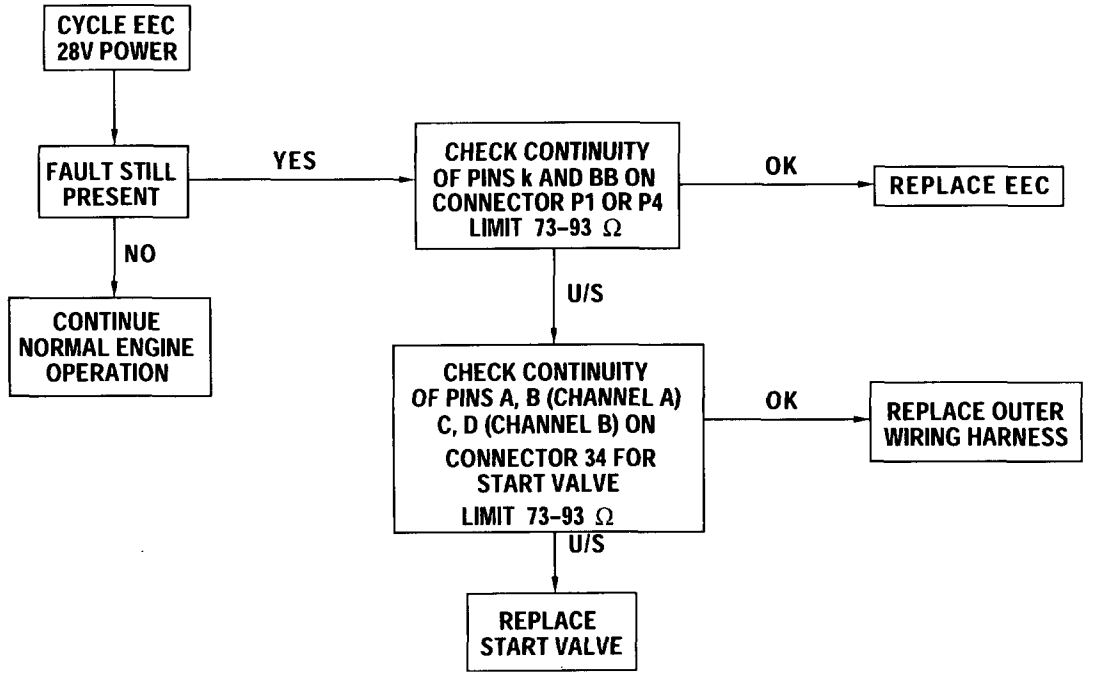
Pre-SB24434/Post-SB24514 C33562B

MFD Codes with LRU Prefix W
Figure 121 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
WE	START VALVE DRIVER FAULT	2

EFFECTS ON SYSTEM -Ⓢ EEC CHANNEL SWITCHOVER
-Ⓓ LOSS OF START VALVE CONTROL

CORRECTIVE ACTION


CYCLE EEC 28V POWER
FAULT STILL PRESENT
YES
NO
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY OF PINS k AND BB ON CONNECTOR P1 OR P4 LIMIT 73-93 Ω
OK
REPLACE EEC
U/S
CHECK CONTINUITY OF PINS A, B (CHANNEL A) C, D (CHANNEL B) ON CONNECTOR 34 FOR START VALVE LIMIT 73-93 Ω
OK
REPLACE OUTER WIRING HARNESS
U/S
REPLACE START VALVE

FOR CHANNEL	CHECK CONNECTORS
A	P1
B	P4

NOTE: Ⓢ = SINGLE CHANNEL FAULT
Ⓓ = DUAL CHANNEL FAULT

Pre-SB24434/Post-SB24514 C64020

MFD Codes with LRU Prefix W
Figure 121 (Sheet 4)

FAULT ISOLATION-4 (POST-SB24434/PRE-SB24514)

1. MFD Codes AB to WE

   A. List of Figures

      (1) Refer to FAULT ISOLATION - 1 for locations of connectors and LRUs.

      (2) Table 101 lists all figures contained in Fault Isolation - 4.

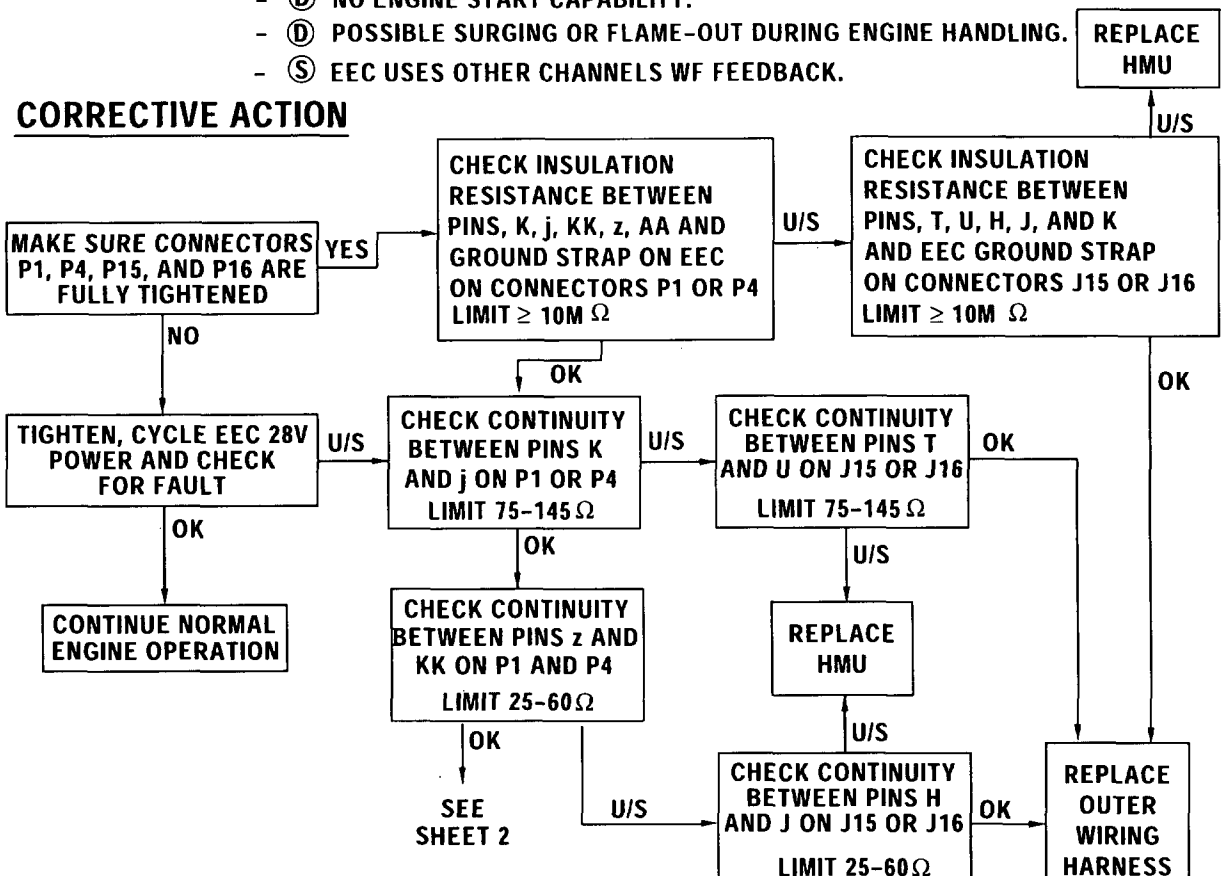
TABLE 101, List of Figures

FIGURE TITLE	FIGURE NO.
MFD Codes with LRU Prefix A	101
MFD Codes with LRU Prefix B	102
MFD Codes with LRU Prefix C	103
MFD Codes with LRU Prefix D	104
MFD Codes with LRU Prefix E	105
MFD Codes with LRU Prefix F	106
MFD Codes with LRU Prefix G	107
MFD Codes with LRU Prefix H	108
MFD Codes with LRU Prefix J	109
MFD Codes with LRU Prefix K	110
MFD Codes with LRU Prefix L	111
MFD Codes with LRU Prefix M	112
MFD Codes with LRU Prefix N	113
MFD Codes with LRU Prefix P	114
MFD Codes with LRU Prefix Q	115
MFD Codes with LRU Prefix R	116
MFD Codes with LRU Prefix S	117
MFD Codes with LRU Prefix T	118
MFD Codes with LRU Prefix V	119
MFD Codes with LRU Prefix W	120

MFD CODE	FAULT	FAULT LEVEL
AB	Wf INPUT RATE OR RANGE	3

EFFECTS ON SYSTEM: - Ⓓ EEC LOSS OF CONTROL; Wf METERING VALVE POSITION EXCEEDS NORMAL OPERATING LIMITS.
- Ⓓ POSSIBLE SLUGGISH ENGINE HANDLING.
- Ⓓ NO ENGINE START CAPABILITY.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓢ EEC USES OTHER CHANNELS WF FEEDBACK.

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P15, AND P16 ARE FULLY TIGHTENED
YES
NO
CHECK INSULATION RESISTANCE BETWEEN PINS, K, j, KK, z, AA AND GROUND STRAP ON EEC ON CONNECTORS P1 OR P4 LIMIT ≥ 10M Ω
U/S
CHECK INSULATION RESISTANCE BETWEEN PINS, T, U, H, J, AND K AND EEC GROUND STRAP ON CONNECTORS J15 OR J16 LIMIT ≥ 10M Ω
REPLACE HMU
U/S
OK
OK
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CHECK CONTINUITY BETWEEN PINS K AND j ON P1 OR P4 LIMIT 75-145 Ω
U/S
CHECK CONTINUITY BETWEEN PINS T AND U ON J15 OR J16 LIMIT 75-145 Ω
OK
OK
U/S
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY BETWEEN PINS z AND KK ON P1 AND P4 LIMIT 25-60Ω
REPLACE HMU
U/S
OK
SEE SHEET 2
U/S
CHECK CONTINUITY BETWEEN PINS H AND J ON J15 OR J16 LIMIT 25-60Ω
OK
REPLACE OUTER WIRING HARNESS

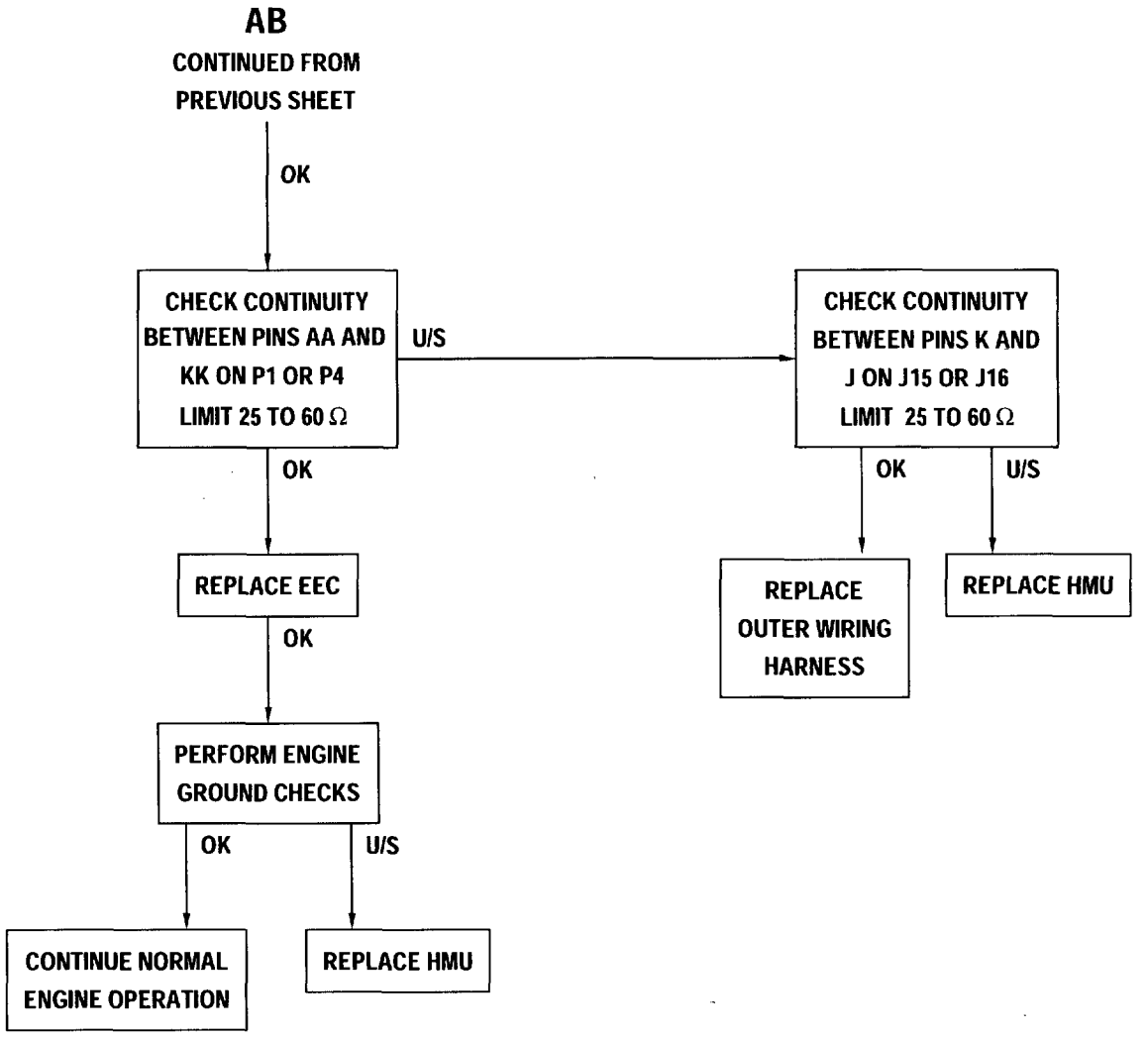
FOR CHANNEL	CHECK CONNECTORS
A	P1, J15
B	P4, J16

NOTE: Ⓢ = SINGLE CHANNEL FAULT
Ⓓ = DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C62160A

MFD Codes with LRU Prefix A
Figure 101 (Sheet 1 of 7)

P&WC Proprietary Information. Subject to the restrictions on the title page.



Post-SB24434/Pre-SB24514 C62161

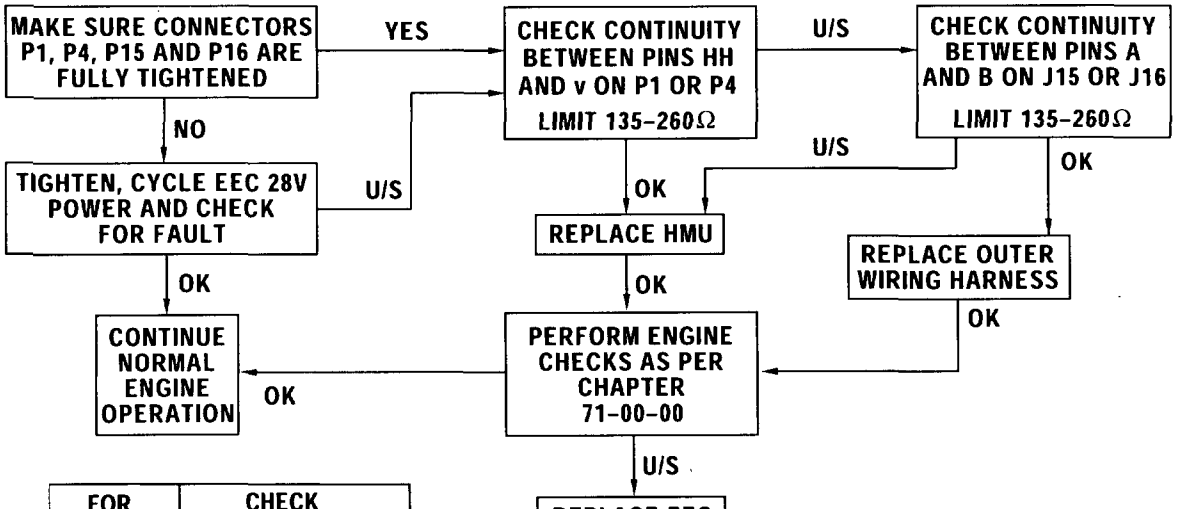
MFD Codes with LRU Prefix A
Figure 101 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
AC	Wf DRIVER	3
AD	Wf CONTROL LOOP (TRACK CHECK)	3

EFFECTS ON SYSTEM - **AC**
- Ⓓ LOSS OF EEC OUTPUT DRIVER TO HMU Wf TORQUEMOTOR.
- Ⓓ EEC LOSS OF CONTROL; Wf METERING VALVE DOES NOT RESPOND TO TLA POSITION.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓓ POSSIBLE ENGINE SHUTDOWN.
- Ⓢ EEC CHANNEL SWITCHOVER.

AD
- Ⓓ LOSS OF HMU Wf TORQUEMOTOR, SERVO, OR METERING VALVE CONTROL.
- Ⓓ EEC LOSS OF METERING VALVE CONTROL; Wf METERING VALVE DOES NOT TRACK.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓓ POSSIBLE ENGINE SHUTDOWN.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P1, J15
B	P4, J16

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

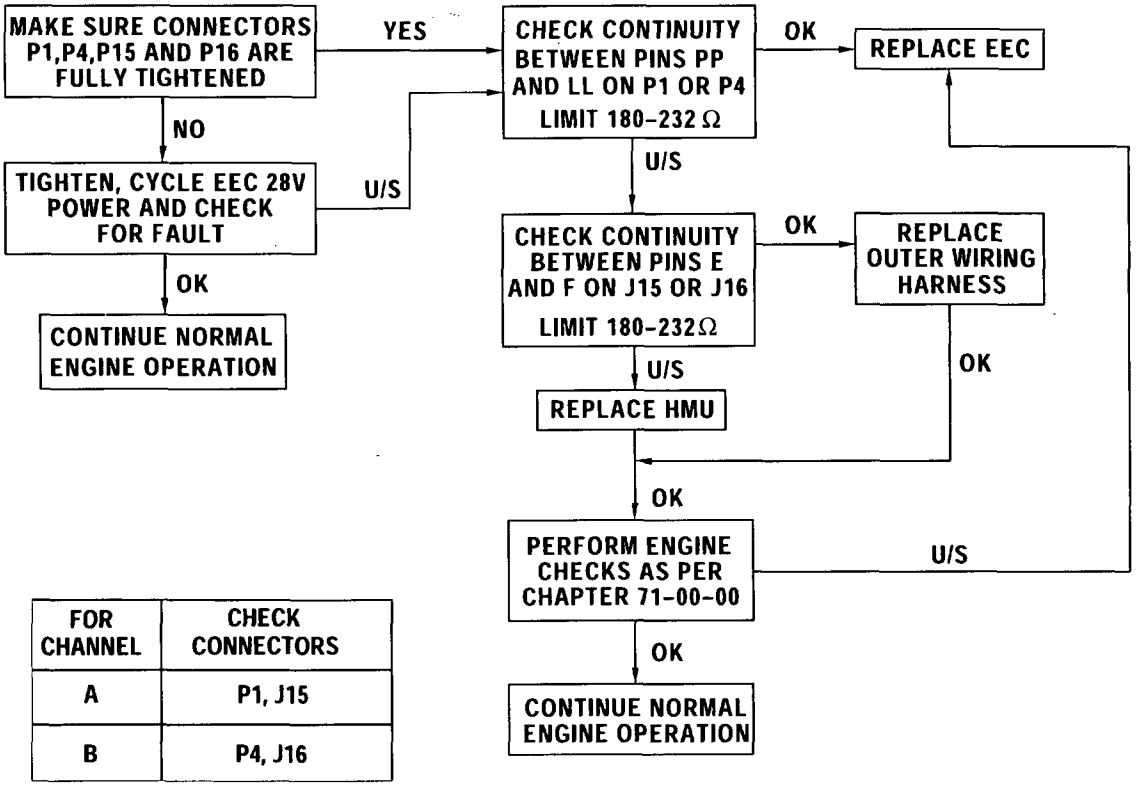
Post-SB24434/Pre-SB24514 C62162A

MFD Codes with LRU Prefix A
Figure 101 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
AE	IGV DRIVER	3

EFFECTS ON SYSTEM
- (D) LOSS OF HMU IGV TORQUEMOTOR SERVO.
- (D) EEC LOSS OF IGV CONTROL; IGV DOES NOT TRACK.
- (D) POSSIBLE SLUGGISH ENGINE HANDLING.
- (D) POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- (D) POSSIBLE STARTING PROBLEMS.
- (D) POSSIBLE ENGINE SHUTDOWN.
- (S) EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P1, J15
B	P4, J16

NOTE: (S)= SINGLE CHANNEL FAULT
(D)= DUAL CHANNEL FAULT

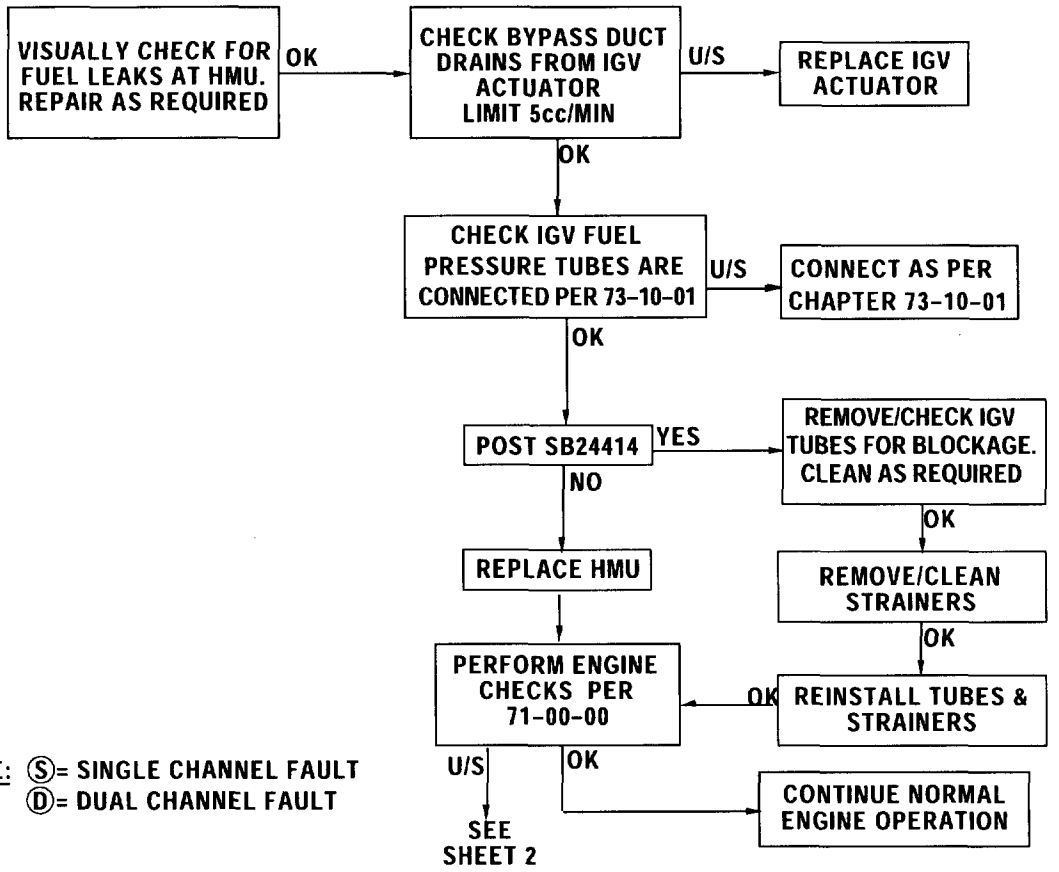
Post-SB24434/Pre-SB24514 C62163A

MFD Codes with LRU Prefix A
Figure 101 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
AF	IGV CONTROL LOOP (LOOSE TRACK CHECK)	3
AH	IGV TRACK CHECK - STEADY STATE	3

EFFECTS ON SYSTEM
- Ⓓ ABORTS ENGINE START WHEN ON GROUND.
- Ⓓ IGV ACTUATOR DOES NOT TRACK EEC COMMANDED POSITION.
- Ⓓ EEC LOSS OF IGV CONTROL; IGV DOES NOT TRACK.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓓ POSSIBLE ENGINE SHUTDOWN.
- Ⓢ EEC CHANNEL SWITCHOVER.

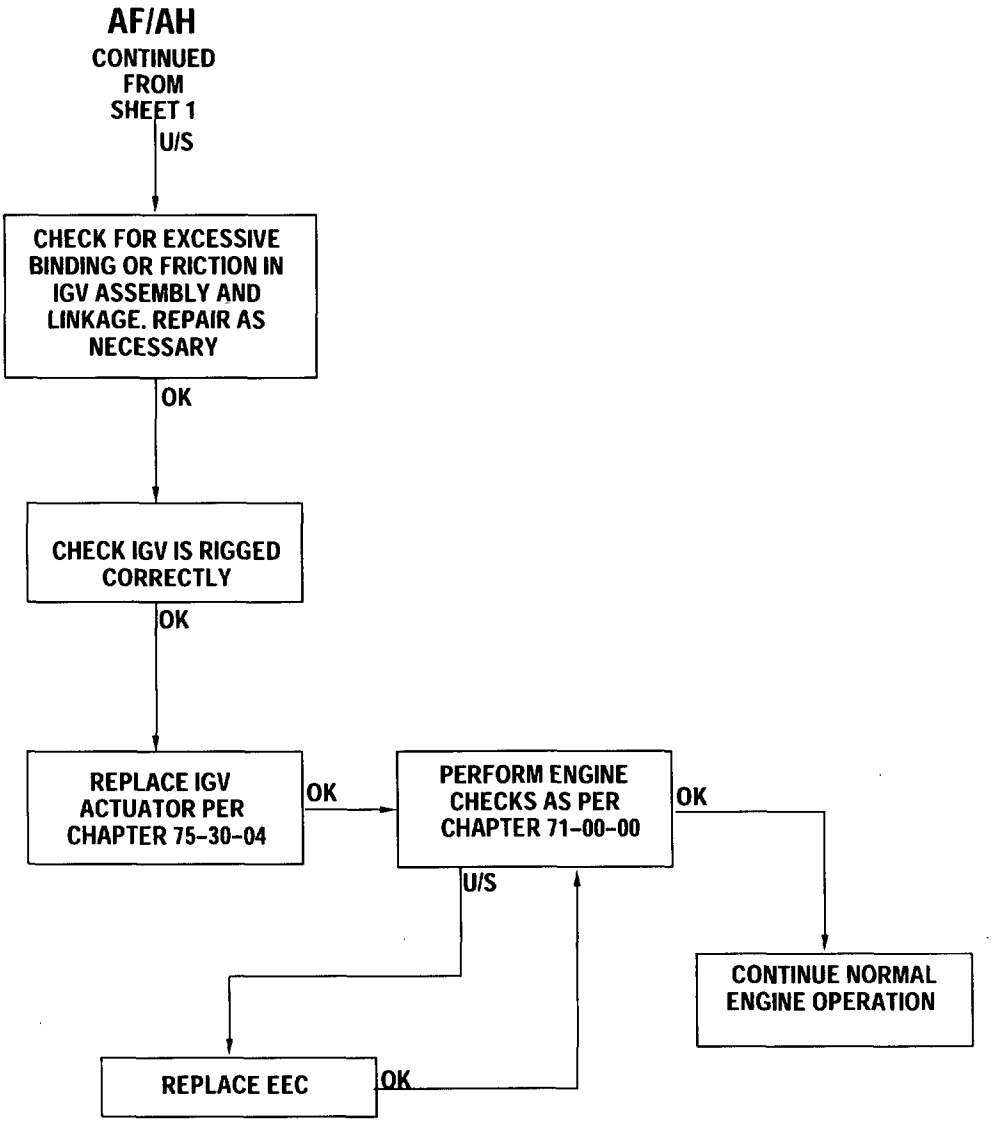
CORRECTIVE ACTION



NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C32894G

MFD Codes with LRU Prefix A
Figure 101 (Sheet 5)



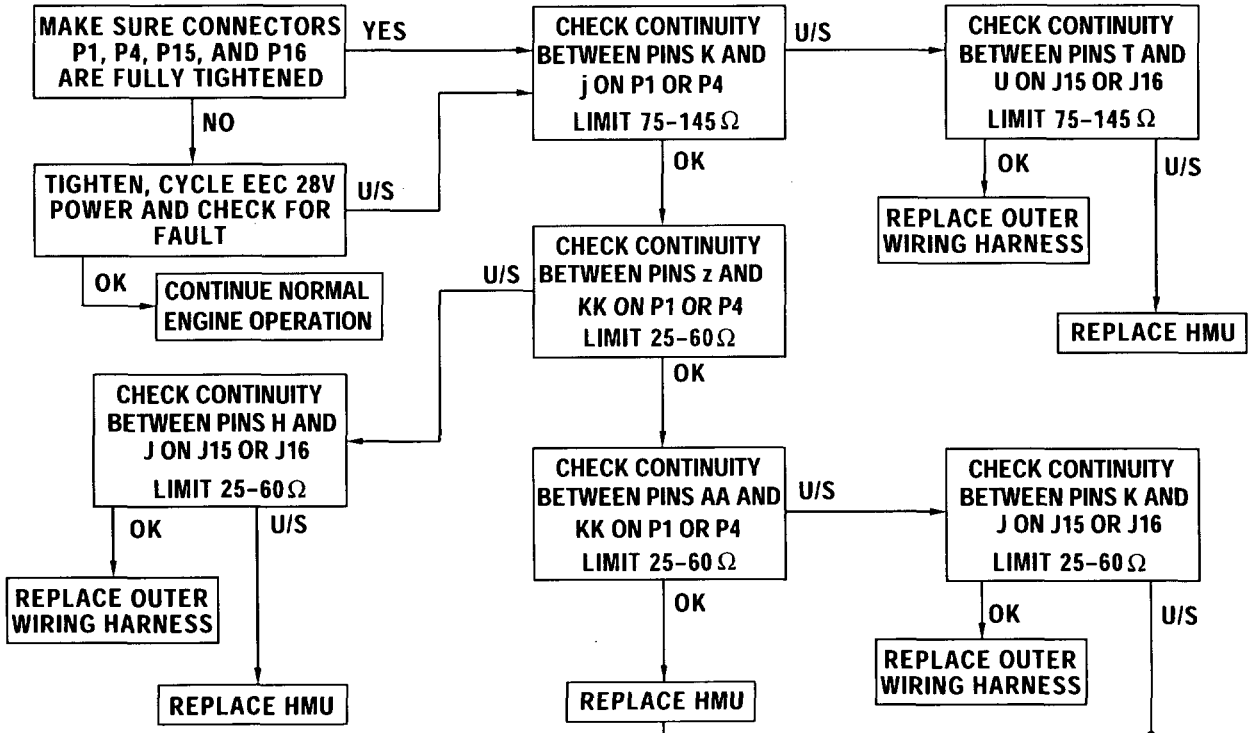
Post-SB24434/Pre-SB24514 C63327

MFD Codes with LRU Prefix A
Figure 101 (Sheet 6)

MFD CODE	FAULT	FAULT LEVEL
AG	METERING VALVE NOT CLOSED	1

EFFECTS ON SYSTEM: - Ⓓ HMU Wf METERING VALVE POSITION NOT IN CUT-OFF WHEN TLA IS IN CUT-OFF DETENT AND N2 IS LESS THAN 5%
- Ⓓ HMU METERING VALVE CANNOT SHUT-OFF FUEL
- Ⓢ EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P15, AND P16 ARE FULLY TIGHTENED
YES
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY BETWEEN PINS K AND j ON P1 OR P4 LIMIT 75-145 Ω
U/S
OK
CHECK CONTINUITY BETWEEN PINS T AND U ON J15 OR J16 LIMIT 75-145 Ω
OK
U/S
REPLACE OUTER WIRING HARNESS
REPLACE HMU
CHECK CONTINUITY BETWEEN PINS z AND KK ON P1 OR P4 LIMIT 25-60 Ω
U/S
OK
CHECK CONTINUITY BETWEEN PINS H AND J ON J15 OR J16 LIMIT 25-60 Ω
OK
U/S
REPLACE OUTER WIRING HARNESS
REPLACE HMU
CHECK CONTINUITY BETWEEN PINS AA AND KK ON P1 OR P4 LIMIT 25-60 Ω
U/S
OK
CHECK CONTINUITY BETWEEN PINS K AND J ON J15 OR J16 LIMIT 25-60 Ω
OK
U/S
REPLACE OUTER WIRING HARNESS
REPLACE HMU
REPLACE HMU
OK
PERFORM ENGINE CHECKS PER CHAPTER 71-00-00
OK
CONTINUE NORMAL ENGINE OPERATION
U/S
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P1, J15
B	P4, J16

NOTE: Ⓢ = SINGLE CHANNEL FAULT
Ⓓ = DUAL CHANNEL FAULT

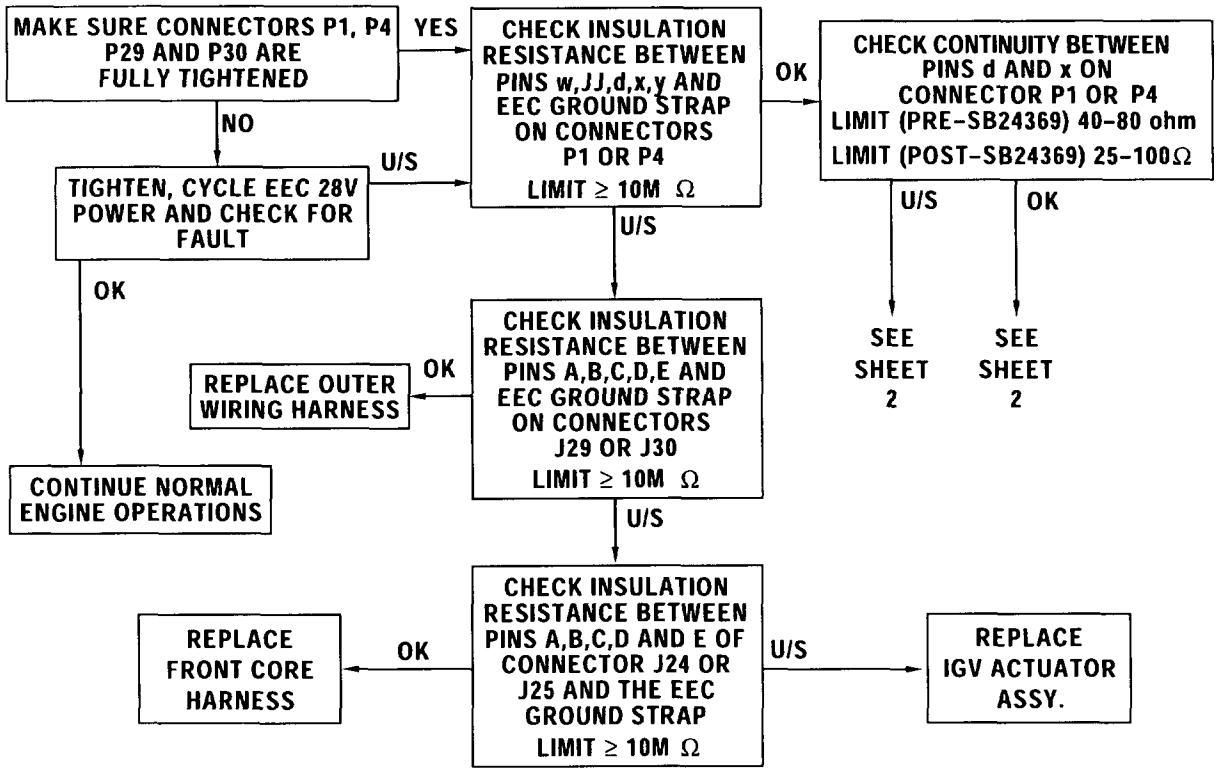
Post-SB24434/Pre-SB24514 C62164A

MFD Codes with LRU Prefix A
Figure 101 (Sheet 7)

MFD CODE	FAULT	FAULT LEVEL
BB	IGV RATE OR RANGE	3

EFFECTS ON SYSTEM - Ⓓ LOSS OF IGV ACTUATOR POSITION.
- Ⓓ IGV DEFAULTS TO FULLY OPEN POSITION.
- Ⓓ POSSIBLE ENGINE HANDLING DIFFICULTIES.
- Ⓓ POSSIBLE SURGING OR FLAME-OUT DURING ENGINE HANDLING.
- Ⓓ POSSIBLE ENGINE SHUTDOWN.
- Ⓢ EEC USES OTHER CHANNEL'S IGV FEEDBACK.

CORRECTIVE ACTION

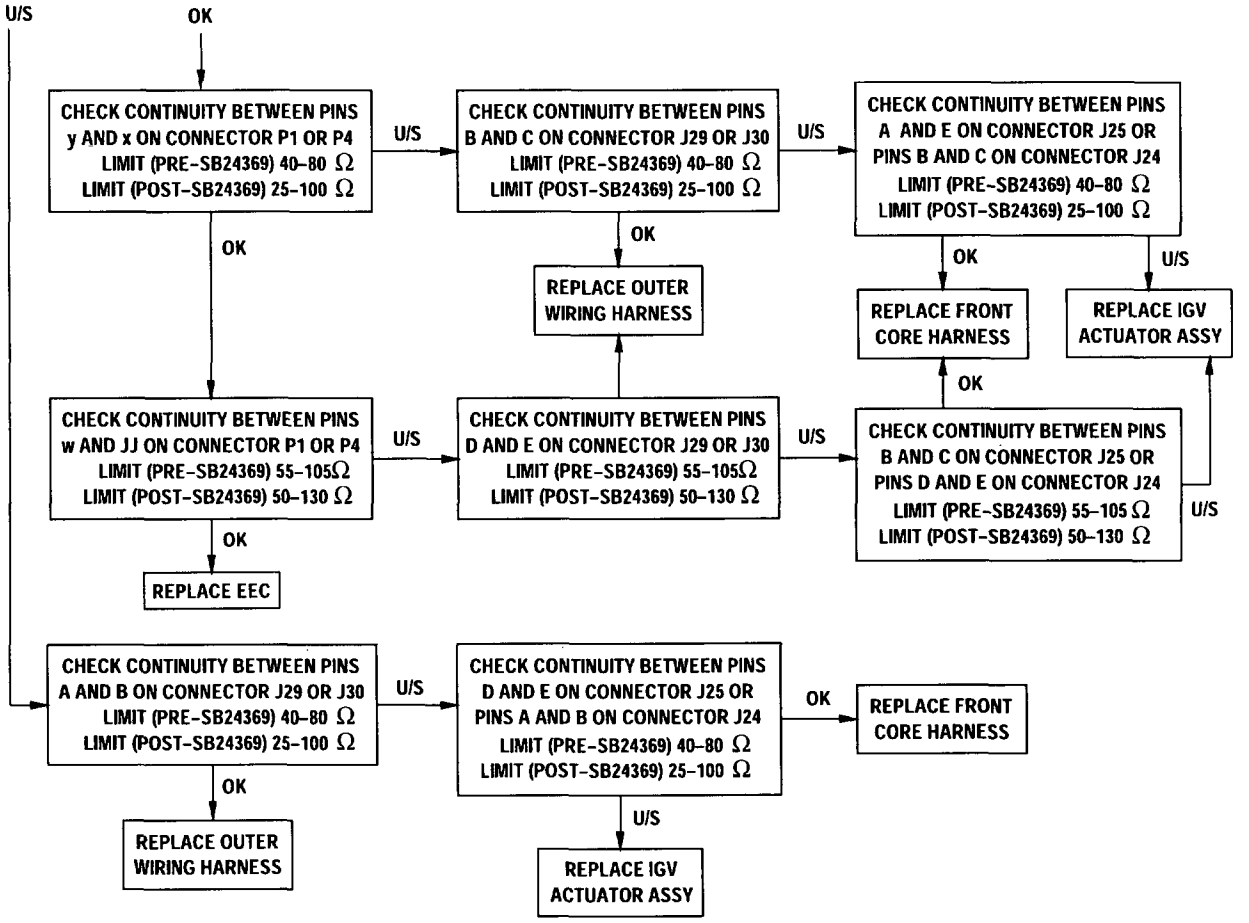

MAKE SURE CONNECTORS P1, P4 P29 AND P30 ARE FULLY TIGHTENED
YES
NO
CHECK INSULATION RESISTANCE BETWEEN PINS w,JJ,d,x,y AND EEC GROUND STRAP ON CONNECTORS P1 OR P4
LIMIT ≥ 10M Ω
OK
CHECK CONTINUITY BETWEEN PINS d AND x ON CONNECTOR P1 OR P4
LIMIT (PRE-SB24369) 40-80 ohm
LIMIT (POST-SB24369) 25-100Ω
U/S
OK
SEE SHEET 2
SEE SHEET 2
U/S
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATIONS
CHECK INSULATION RESISTANCE BETWEEN PINS A,B,C,D,E AND EEC GROUND STRAP ON CONNECTORS J29 OR J30
LIMIT ≥ 10M Ω
OK
REPLACE OUTER WIRING HARNESS
U/S
CHECK INSULATION RESISTANCE BETWEEN PINS A,B,C,D AND E OF CONNECTOR J24 OR J25 AND THE EEC GROUND STRAP
LIMIT ≥ 10M Ω
OK
REPLACE FRONT CORE HARNESS
U/S
REPLACE IGV ACTUATOR ASSY.

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C85331

MFD Codes with LRU Prefix B
Figure 102 (Sheet 1 of 2)

BB CONTINUED FROM SHEET 1


U/S
OK
CHECK CONTINUITY BETWEEN PINS y AND x ON CONNECTOR P1 OR P4 LIMIT (PRE-SB24369) 40-80 Ω LIMIT (POST-SB24369) 25-100 Ω
U/S
CHECK CONTINUITY BETWEEN PINS B AND C ON CONNECTOR J29 OR J30 LIMIT (PRE-SB24369) 40-80 Ω LIMIT (POST-SB24369) 25-100 Ω
U/S
CHECK CONTINUITY BETWEEN PINS A AND E ON CONNECTOR J25 OR PINS B AND C ON CONNECTOR J24 LIMIT (PRE-SB24369) 40-80 Ω LIMIT (POST-SB24369) 25-100 Ω
OK
OK
REPLACE OUTER WIRING HARNESS
OK
U/S
REPLACE FRONT CORE HARNESS
REPLACE IGV ACTUATOR ASSY
OK
CHECK CONTINUITY BETWEEN PINS w AND JJ ON CONNECTOR P1 OR P4 LIMIT (PRE-SB24369) 55-105Ω LIMIT (POST-SB24369) 50-130 Ω
U/S
CHECK CONTINUITY BETWEEN PINS D AND E ON CONNECTOR J29 OR J30 LIMIT (PRE-SB24369) 55-105Ω LIMIT (POST-SB24369) 50-130 Ω
U/S
CHECK CONTINUITY BETWEEN PINS B AND C ON CONNECTOR J25 OR PINS D AND E ON CONNECTOR J24 LIMIT (PRE-SB24369) 55-105 Ω LIMIT (POST-SB24369) 50-130 Ω
U/S
OK
REPLACE EEC
CHECK CONTINUITY BETWEEN PINS A AND B ON CONNECTOR J29 OR J30 LIMIT (PRE-SB24369) 40-80 Ω LIMIT (POST-SB24369) 25-100 Ω
U/S
CHECK CONTINUITY BETWEEN PINS D AND E ON CONNECTOR J25 OR PINS A AND B ON CONNECTOR J24 LIMIT (PRE-SB24369) 40-80 Ω LIMIT (POST-SB24369) 25-100 Ω
OK
REPLACE FRONT CORE HARNESS
OK
U/S
REPLACE OUTER WIRING HARNESS
REPLACE IGV ACTUATOR ASSY

FOR CHANNEL	CHECK CONNECTORS
A	P1, J25, P29, J29
B	P4, J24, P30, J30

Post-SB24434/Pre-SB24514 C85336

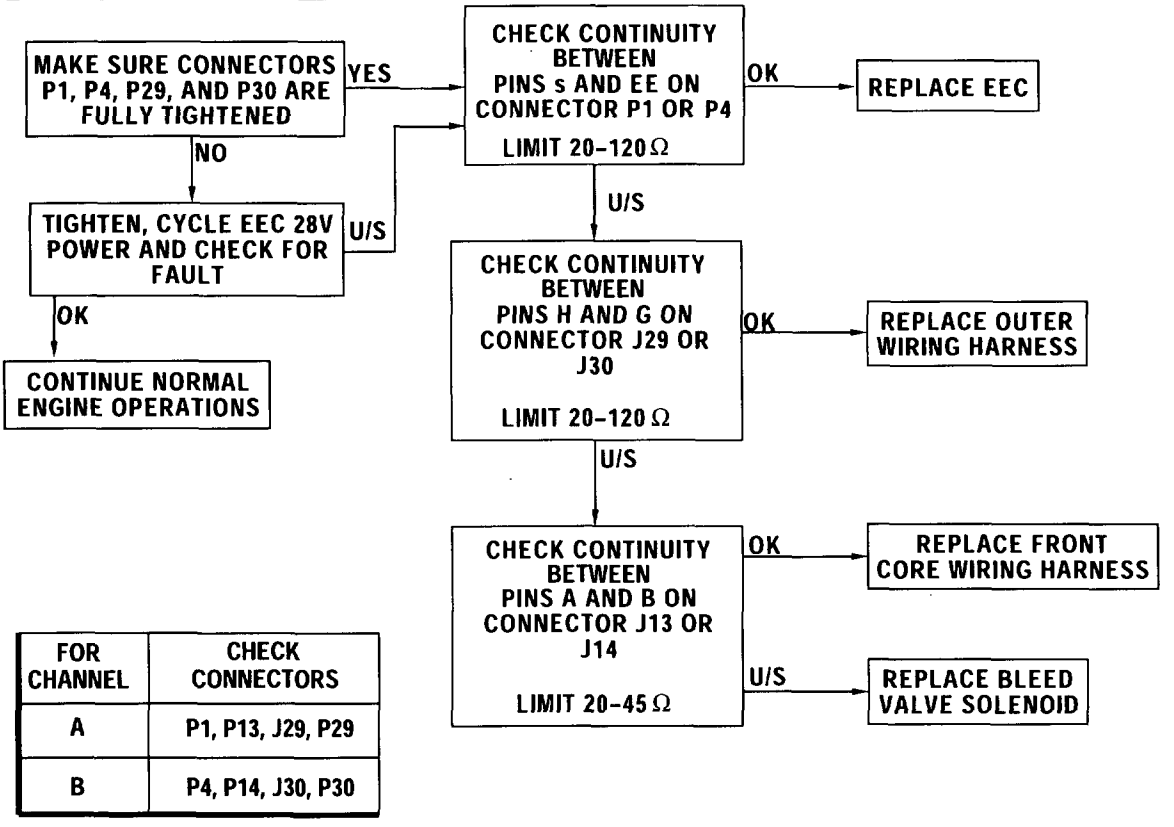
MFD Codes with LRU Prefix B
Figure 102 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
CA	BOV SOLENOID EXTERNAL OPEN CIRCUIT	2

EFFECTS ON SYSTEM - Ⓓ LOSS OF CONTROL OF BLEED VALVE SOLENOID.
- Ⓓ BLEED VALVE REMAINS OPEN.
- Ⓓ POSSIBLE LOSS OF EXPECTED ENGINE THRUST.
- Ⓓ HIGH T45 OPERATING TEMPERATURE.
- Ⓢ EEC CHANNEL SWITCHOVER.
- Ⓓ POSSIBLE OVERTEMPERATURE OF ACCESSORIES.

CHECK - BOV SOLENOIDS
- IGV ACTUATOR
- ANTI-ICE SOLENOID
- FRONT CORE HARNESS
- #3 BRG SCAVENGE OIL PIPE FOR LEAKAGE

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P29, AND P30 ARE FULLY TIGHTENED
YES
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATIONS
CHECK CONTINUITY BETWEEN PINS s AND EE ON CONNECTOR P1 OR P4
LIMIT 20-120 Ω
OK
REPLACE EEC
U/S
CHECK CONTINUITY BETWEEN PINS H AND G ON CONNECTOR J29 OR J30
LIMIT 20-120 Ω
OK
REPLACE OUTER WIRING HARNESS
U/S
CHECK CONTINUITY BETWEEN PINS A AND B ON CONNECTOR J13 OR J14
LIMIT 20-45 Ω
OK
REPLACE FRONT CORE WIRING HARNESS
U/S
REPLACE BLEED VALVE SOLENOID

FOR CHANNEL	CHECK CONNECTORS
A	P1, P13, J29, P29
B	P4, P14, J30, P30

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

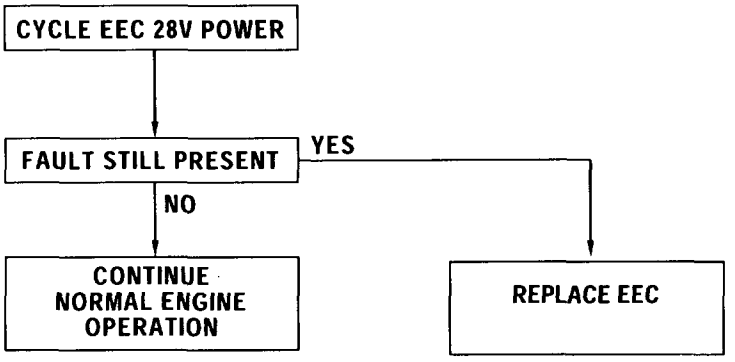
Post-SB24434/Pre-SB24514 C63352A

MFD Codes with LRU Prefix C
Figure 103 (Sheet 1 of 5)

MFD CODE	FAULT	FAULT LEVEL
CB	BOV DRIVE INTERNAL OPEN CIRCUIT	2

EFFECTS ON SYSTEM
- Ⓓ LOSS OF EEC BLEED VALVE SOLENOID OUTPUT DRIVER.
- Ⓓ BLEED VALVE REMAINS OPEN.
- Ⓓ POSSIBLE LOSS OF EXPECTED ENGINE THRUST.
- Ⓓ HIGH T45 OPERATING TEMPERATURE.
- Ⓢ EEC CHANNEL SWITCHOVER.

CORRECTIVE ACTION



NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

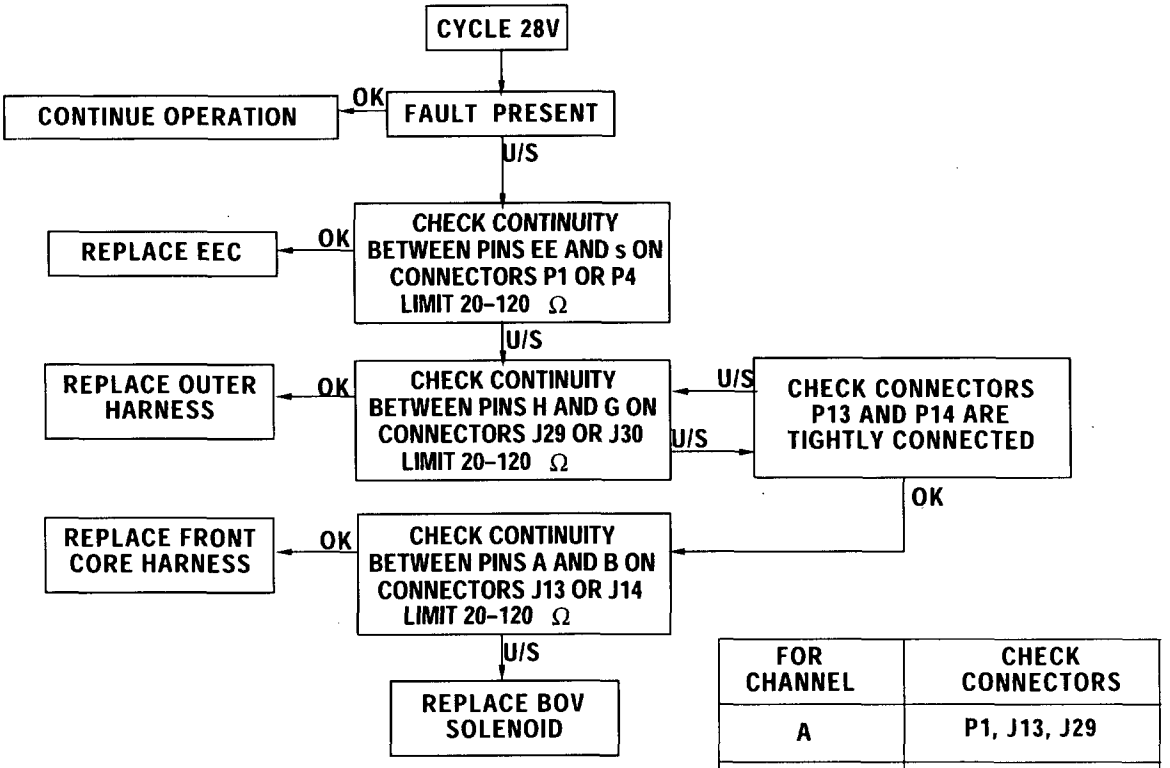
Post-SB24434/Pre-SB24514 C61770B

MFD Codes with LRU Prefix C
Figure 103 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
CC	BOV DRIVE INTERNAL OR EXTERNAL SHORT CIRCUIT OR EXTERNAL OPEN CIRCUIT	2

EFFECTS ON SYSTEM - Ⓓ LOSS OF EEC BLEED VALVE SOLENOID OUTPUT DRIVER.
- Ⓓ BLEED VALVE REMAINS CLOSED.
- Ⓓ POSSIBLE ENGINE SURGING DURING ENGINE HANDLING.
- Ⓓ POSSIBLE ENGINE HUNG DURING START.
- Ⓢ EEC CHANNEL SWITCHOVER.
- Ⓓ POSSIBLE LOSS OF EXPECTED ENGINE THRUST.

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P1, J13, J29
B	P4, J14, J30

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C63358B

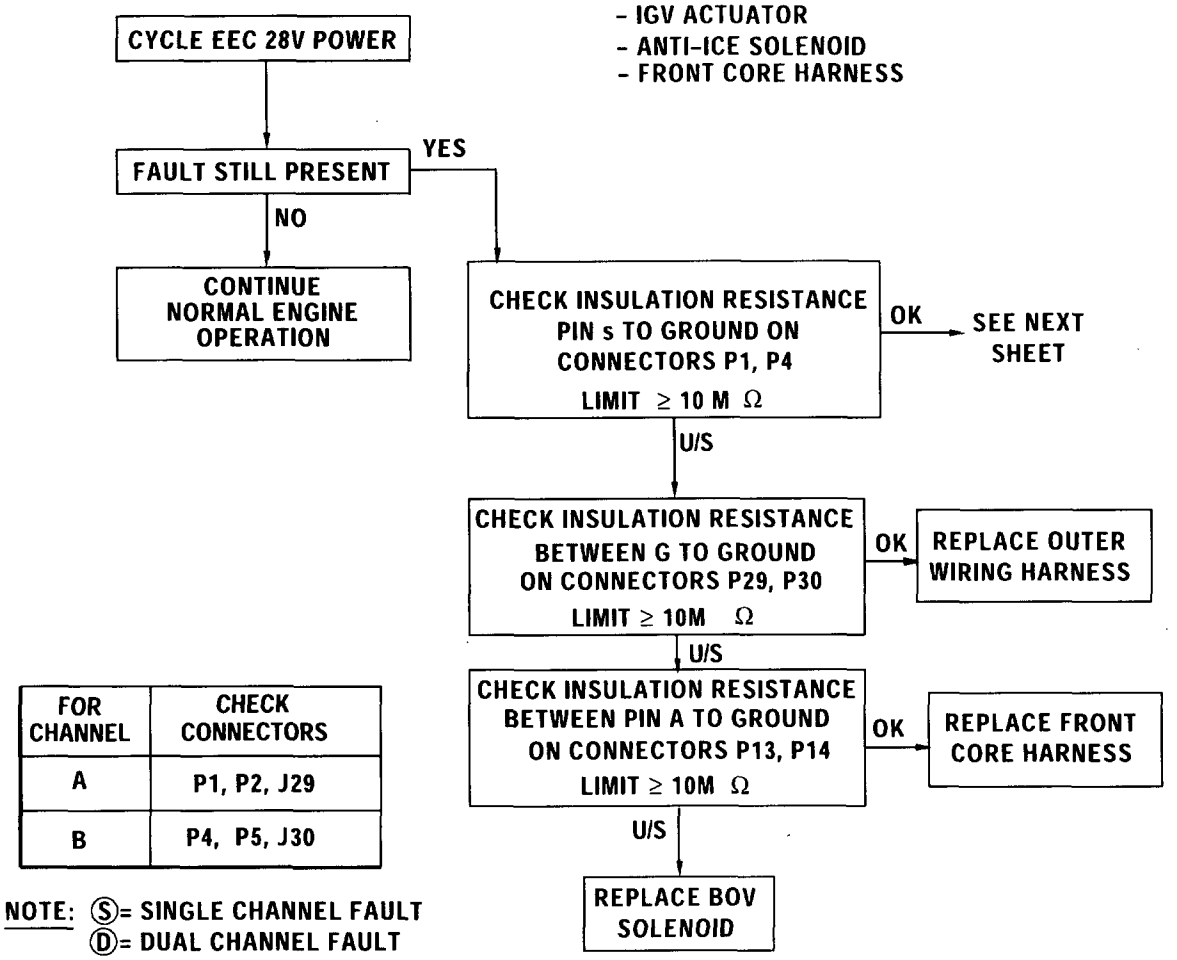
MFD Codes with LRU Prefix C
Figure 103 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
CD	SOLENOID & RELAYS OUTPUT DRIVERS FAULT (BOV, APR ARMED & ACHIEVED)	2

EFFECTS ON SYSTEM - Ⓓ POSSIBLE LOSS OF EXPECTED ENGINE THRUST
- Ⓓ HIGH T45 OPERATING TEMPERATURE
- Ⓢ EEC CHANNEL SWITCHOVER
- Ⓓ POSSIBLE LOSS OF APR ARMED INDICATION, APR ACHIEVED INDICATION AND/OR BOV CONTROL (ANY OF THE ABOVE 3, OR COMBINATION)
- Ⓓ OVERTEMPERATURE OF ACCESSORIES

CORRECTIVE ACTION

CHECK - BOV SOLENOID
- IGV ACTUATOR
- ANTI-ICE SOLENOID
- FRONT CORE HARNESS

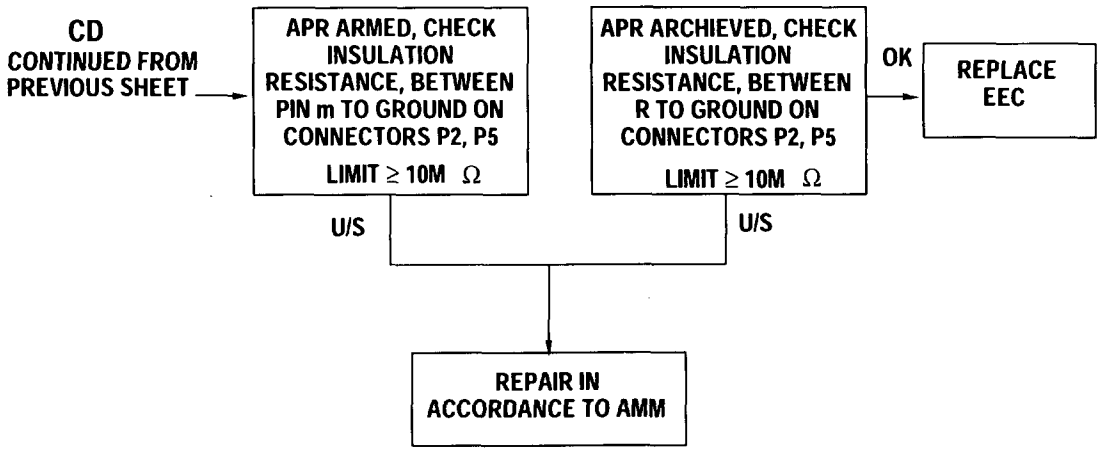


FOR CHANNEL	CHECK CONNECTORS
A	P1, P2, J29
B	P4, P5, J30

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C62167B

MFD Codes with LRU Prefix C
Figure 103 (Sheet 4)


CD
CONTINUED FROM PREVIOUS SHEET
APR ARMED, CHECK INSULATION RESISTANCE, BETWEEN PIN m TO GROUND ON CONNECTORS P2, P5
LIMIT ≥ 10M Ω
U/S
APR ARCHIEVED, CHECK INSULATION RESISTANCE, BETWEEN R TO GROUND ON CONNECTORS P2, P5
LIMIT ≥ 10M Ω
U/S
OK
REPLACE EEC
REPAIR IN ACCORDANCE TO AMM

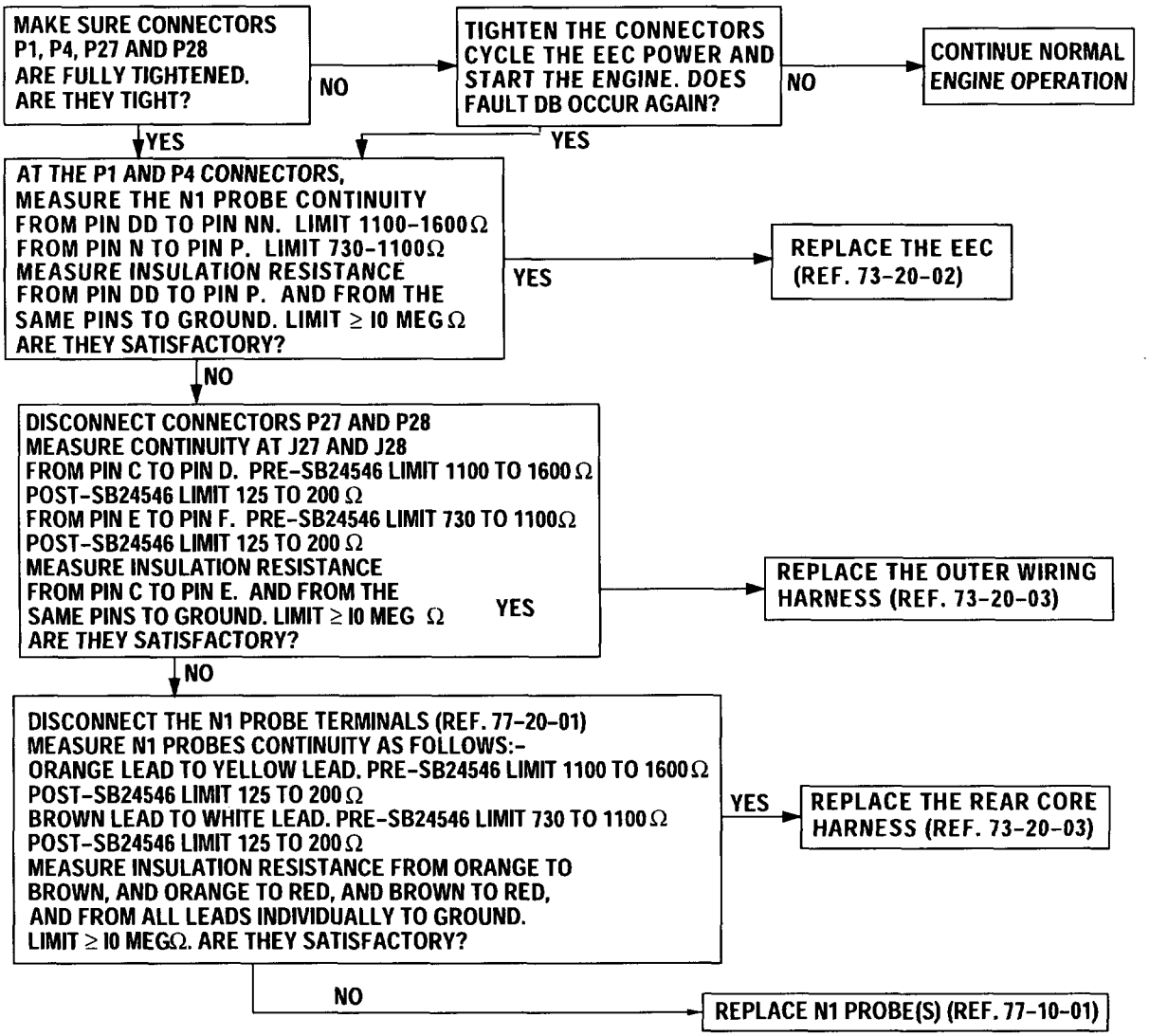
Post-SB24434/Pre-SB24514 C63086

MFD Codes with LRU Prefix C
Figure 103 (Sheet 5)

FAULT CODE	FAULT	FAULT LEVEL
DB	N1 RATE OR RANGE	2

EFFECTS ON SYSTEM - Ⓓ EEC CONTROL DEFAULTS TO N1 BACK-UP AS A FUNCTION OF N2
- Ⓓ ATTCS DISARMED
- Ⓓ N1 POWER SETTING BASED ON N2
- Ⓓ LOSS OF N1 SOFTWARE OVERSPEED PROTECTION
- Ⓓ POSSIBLE CHANGE IN ENGINE THRUST
- Ⓢ EEC USES N1 DATA FROM OTHER CHANNEL

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P27 AND P28 ARE FULLY TIGHTENED. ARE THEY TIGHT?
NO
TIGHTEN THE CONNECTORS CYCLE THE EEC POWER AND START THE ENGINE. DOES FAULT DB OCCUR AGAIN?
NO
CONTINUE NORMAL ENGINE OPERATION
YES
YES
AT THE P1 AND P4 CONNECTORS, MEASURE THE N1 PROBE CONTINUITY FROM PIN DD TO PIN NN. LIMIT 1100-1600Ω FROM PIN N TO PIN P. LIMIT 730-1100Ω MEASURE INSULATION RESISTANCE FROM PIN DD TO PIN P. AND FROM THE SAME PINS TO GROUND. LIMIT ≥ 10 MEG Ω ARE THEY SATISFACTORY?
YES
REPLACE THE EEC (REF. 73-20-02)
NO
DISCONNECT CONNECTORS P27 AND P28 MEASURE CONTINUITY AT J27 AND J28 FROM PIN C TO PIN D. PRE-SB24546 LIMIT 1100 TO 1600 Ω POST-SB24546 LIMIT 125 TO 200 Ω FROM PIN E TO PIN F. PRE-SB24546 LIMIT 730 TO 1100Ω POST-SB24546 LIMIT 125 TO 200 Ω MEASURE INSULATION RESISTANCE FROM PIN C TO PIN E. AND FROM THE SAME PINS TO GROUND. LIMIT ≥ 10 MEG Ω ARE THEY SATISFACTORY?
YES
REPLACE THE OUTER WIRING HARNESS (REF. 73-20-03)
NO
DISCONNECT THE N1 PROBE TERMINALS (REF. 77-20-01) MEASURE N1 PROBES CONTINUITY AS FOLLOWS:- ORANGE LEAD TO YELLOW LEAD. PRE-SB24546 LIMIT 1100 TO 1600 Ω POST-SB24546 LIMIT 125 TO 200 Ω BROWN LEAD TO WHITE LEAD. PRE-SB24546 LIMIT 730 TO 1100 Ω POST-SB24546 LIMIT 125 TO 200 Ω MEASURE INSULATION RESISTANCE FROM ORANGE TO BROWN, AND ORANGE TO RED, AND BROWN TO RED, AND FROM ALL LEADS INDIVIDUALLY TO GROUND. LIMIT ≥ 10 MEGΩ. ARE THEY SATISFACTORY?
YES
REPLACE THE REAR CORE HARNESS (REF. 73-20-03)
NO
REPLACE N1 PROBE(S) (REF. 77-10-01)

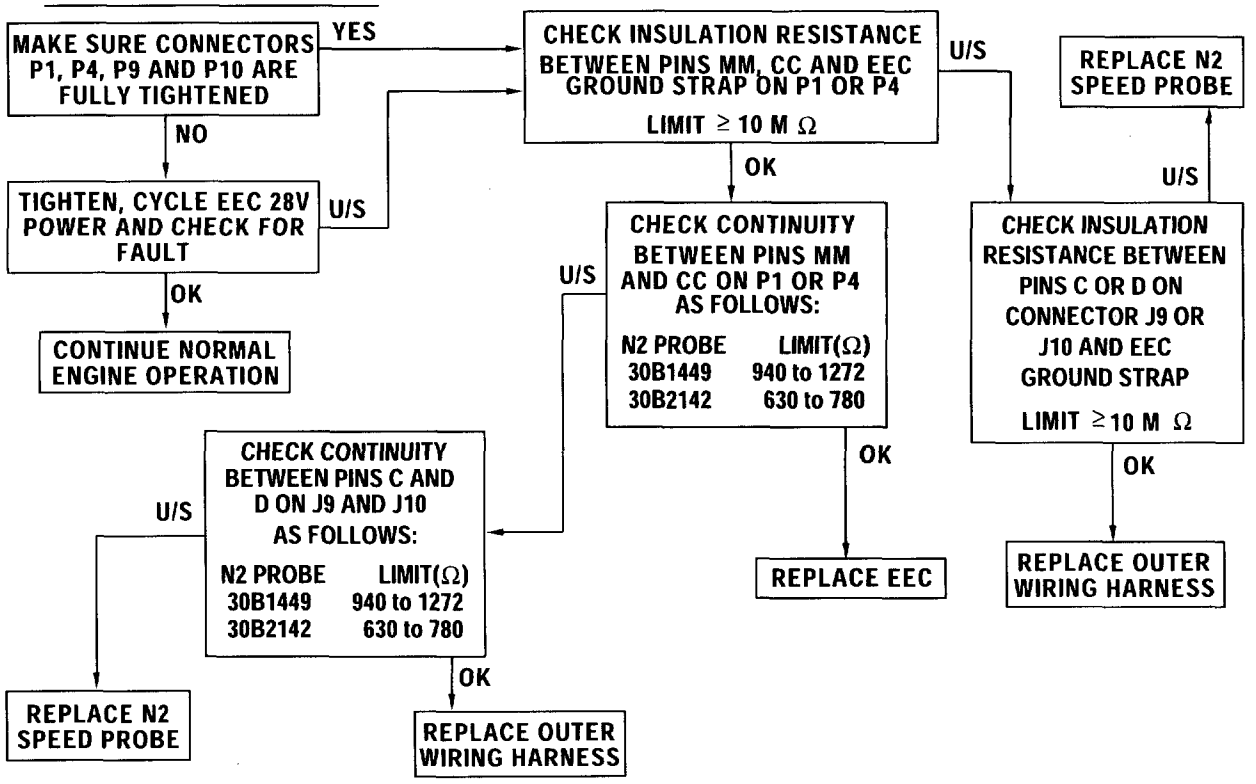
Post-SB24434/Pre-SB24514 C96722B

MFD Codes with LRU Prefix D
Figure 104

MFD CODE	FAULT	FAULT LEVEL
EB	N2 RATE OR RANGE	2

EFFECTS ON SYSTEM - Ⓓ EEC CONTROL DEFAULTS TO N2 BACK-UP LOOP AS A FUNCTION OF N1
- Ⓓ ENGINE IDLE SPEED BASED ON A FUNCTION OF N1
- Ⓓ ATTCS DISARMED
- Ⓓ IGV AND BOV SCHEDULES BASED ON A FUNCTION OF N1
- Ⓓ LOSS OF N2 SOFTWARE OVERSPEED PROTECTION
- Ⓓ POSSIBLE CHANGE IN ENGINE ACCEL AND DECEL RATES
- Ⓓ POSSIBLE ENGINE SURGING DURING ENGINE HANDLING
- Ⓢ EEC USES N2 DATA FROM OTHER CHANNEL.

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P9 AND P10 ARE FULLY TIGHTENED
YES
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATION
CHECK INSULATION RESISTANCE BETWEEN PINS MM, CC AND EEC GROUND STRAP ON P1 OR P4
LIMIT ≥ 10 M Ω
U/S
OK
REPLACE N2 SPEED PROBE
U/S
CHECK CONTINUITY BETWEEN PINS MM AND CC ON P1 OR P4 AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 940 to 1272
30B2142 630 to 780
U/S
OK
REPLACE EEC
CHECK INSULATION RESISTANCE BETWEEN PINS C OR D ON CONNECTOR J9 OR J10 AND EEC GROUND STRAP
LIMIT ≥10 M Ω
OK
REPLACE OUTER WIRING HARNESS
CHECK CONTINUITY BETWEEN PINS C AND D ON J9 AND J10 AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 940 to 1272
30B2142 630 to 780
U/S
OK
REPLACE N2 SPEED PROBE
REPLACE OUTER WIRING HARNESS

FOR CHANNEL	CHECK CONNECTORS
A	P1,J9
B	P4,J10

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

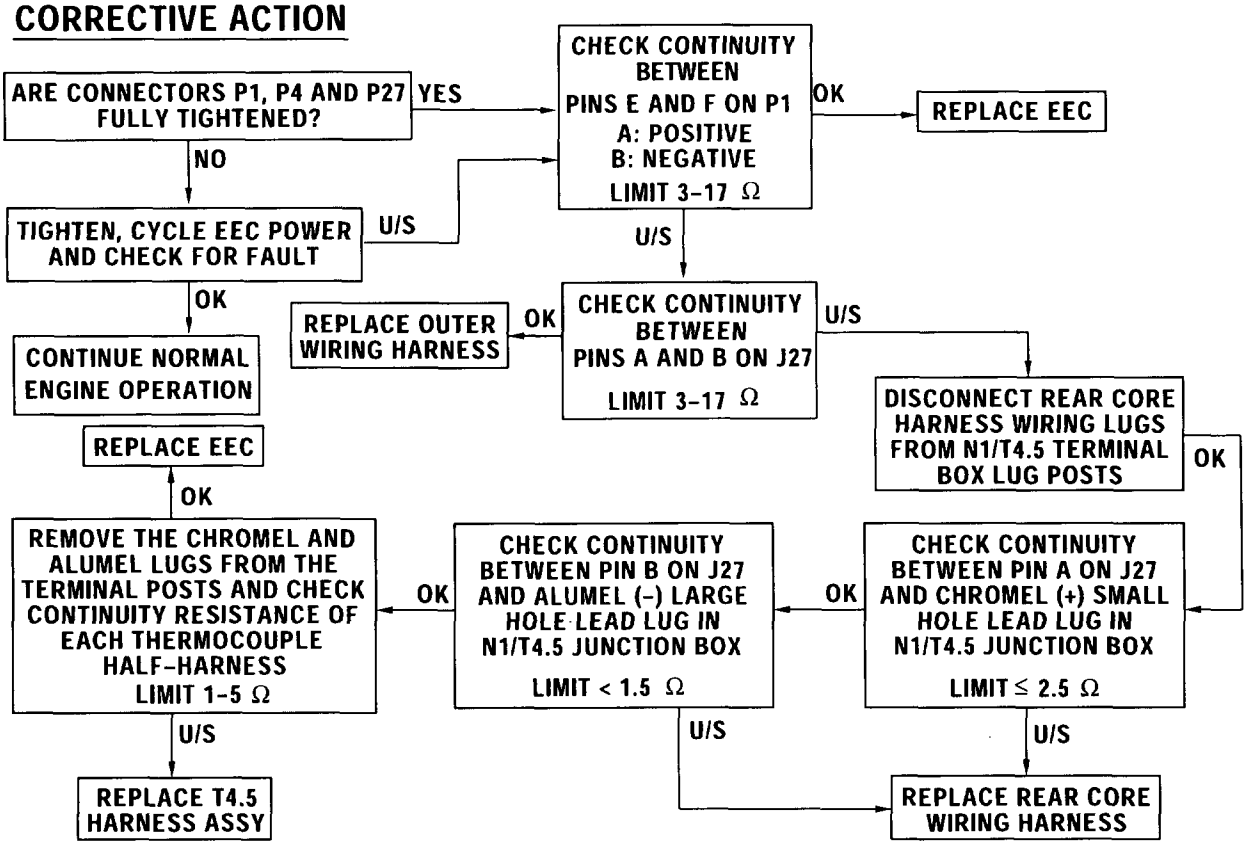
Post-SB24434/Pre-SB24514 C62171A

MFD Codes with LRU Prefix E
Figure 105

MFD CODE	FAULT	FAULT LEVEL
FB	T45 RATE OR RANGE	2

EFFECTS ON SYSTEM - Ⓓ DISABLES T45 LIMITER
- Ⓓ NO T45 LIMITING ON ENGINE STARTS
- Ⓓ LOSS OF T45 COCKPIT INDICATION; INDICATION DEFAULTS TO "---"

CORRECTIVE ACTION


ARE CONNECTORS P1, P4 AND P27 FULLY TIGHTENED?
YES
NO
CHECK CONTINUITY BETWEEN PINS E AND F ON P1
A: POSITIVE
B: NEGATIVE
LIMIT 3-17 Ω
OK
REPLACE EEC
U/S
TIGHTEN, CYCLE EEC POWER AND CHECK FOR FAULT
U/S
OK
CONTINUE NORMAL ENGINE OPERATION
REPLACE OUTER WIRING HARNESS
OK
CHECK CONTINUITY BETWEEN PINS A AND B ON J27
LIMIT 3-17 Ω
U/S
DISCONNECT REAR CORE HARNESS WIRING LUGS FROM N1/T4.5 TERMINAL BOX LUG POSTS
OK
REPLACE EEC
OK
REMOVE THE CHROMEL AND ALUMEL LUGS FROM THE TERMINAL POSTS AND CHECK CONTINUITY RESISTANCE OF EACH THERMOCOUPLE HALF-HARNESS
LIMIT 1-5 Ω
OK
CHECK CONTINUITY BETWEEN PIN B ON J27 AND ALUMEL (-) LARGE HOLE LEAD LUG IN N1/T4.5 JUNCTION BOX
LIMIT < 1.5 Ω
OK
CHECK CONTINUITY BETWEEN PIN A ON J27 AND CHROMEL (+) SMALL HOLE LEAD LUG IN N1/T4.5 JUNCTION BOX
LIMIT ≤ 2.5 Ω
U/S
REPLACE T4.5 HARNESS ASSY
U/S
U/S
REPLACE REAR CORE WIRING HARNESS

NOTE: Ⓓ= DUAL CHANNEL FAULT

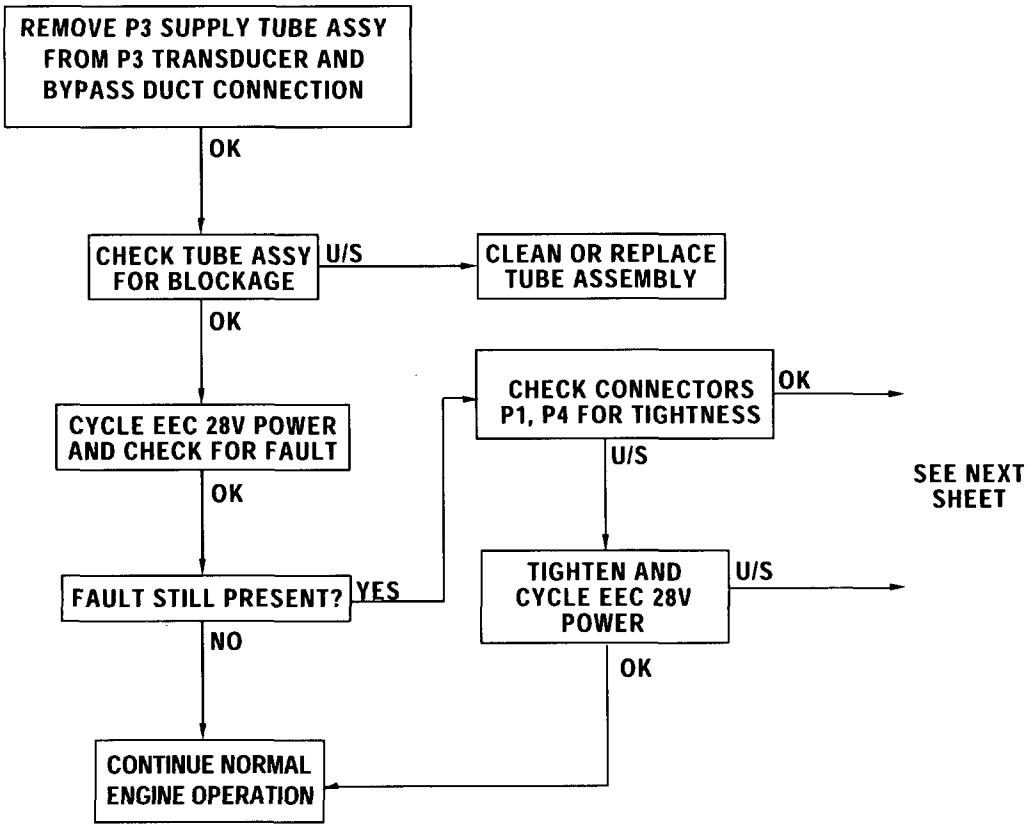
Post-SB24434/Pre-SB24514 C62172B

MFD Codes with LRU Prefix F
Figure 106

MFD CODE	FAULT	FAULT LEVEL
GB	P3 RANGE	2

EFFECTS ON SYSTEM - Ⓓ POSSIBLE REDUCTION IN ENGINE THRUST
- Ⓓ EEC CONTROLS ON SYNTHESIZED P3 AS A FUNCTION OF CORRECTED N2 AND TOTAL INLET AIR PRESSURE
- Ⓢ EEC USES P3 DATA FROM OTHER CHANNEL

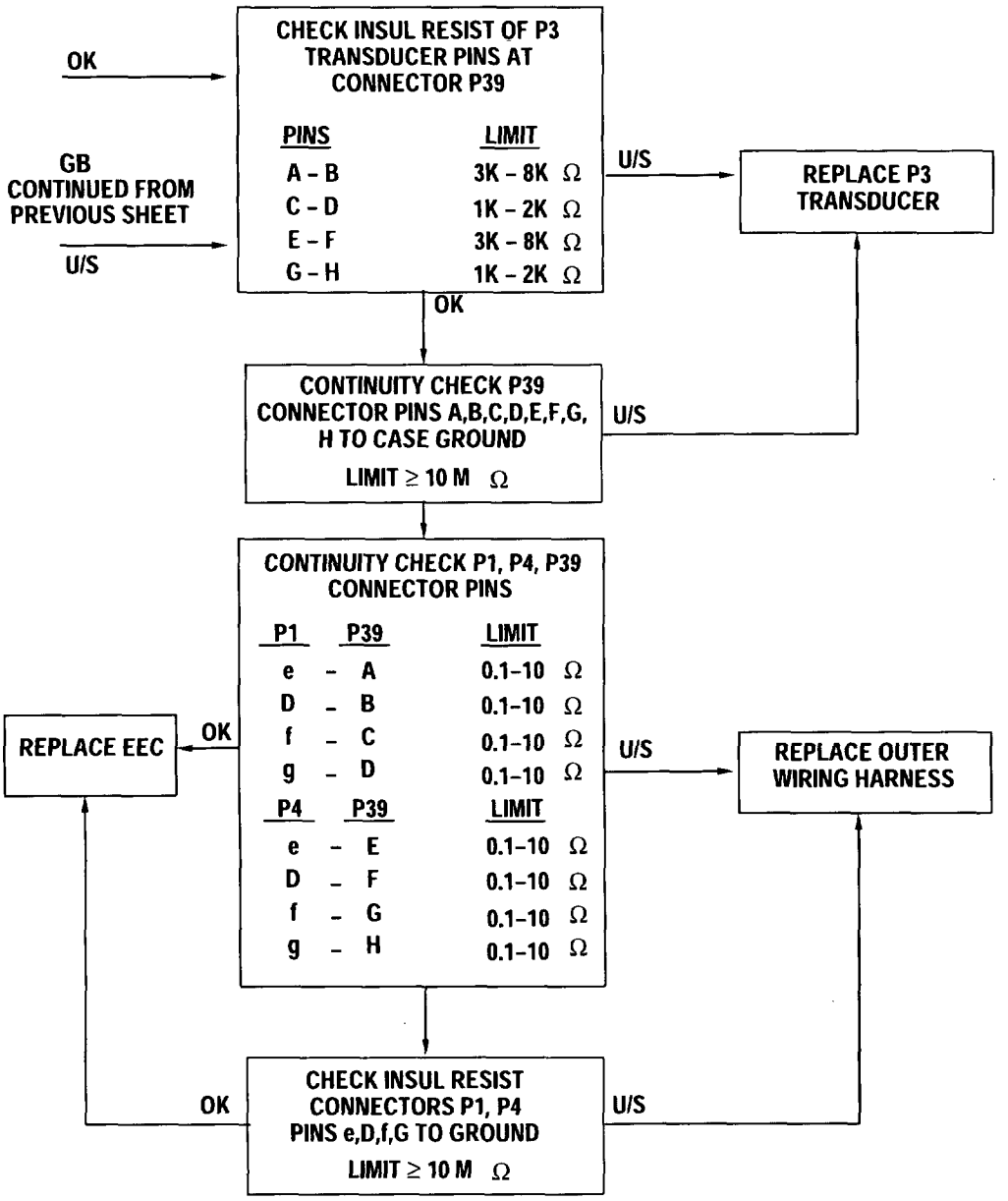
CORRECTIVE ACTION



NOTE: Ⓓ= DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C62065A

MFD Codes with LRU Prefix G
Figure 107 (Sheet 1 of 2)



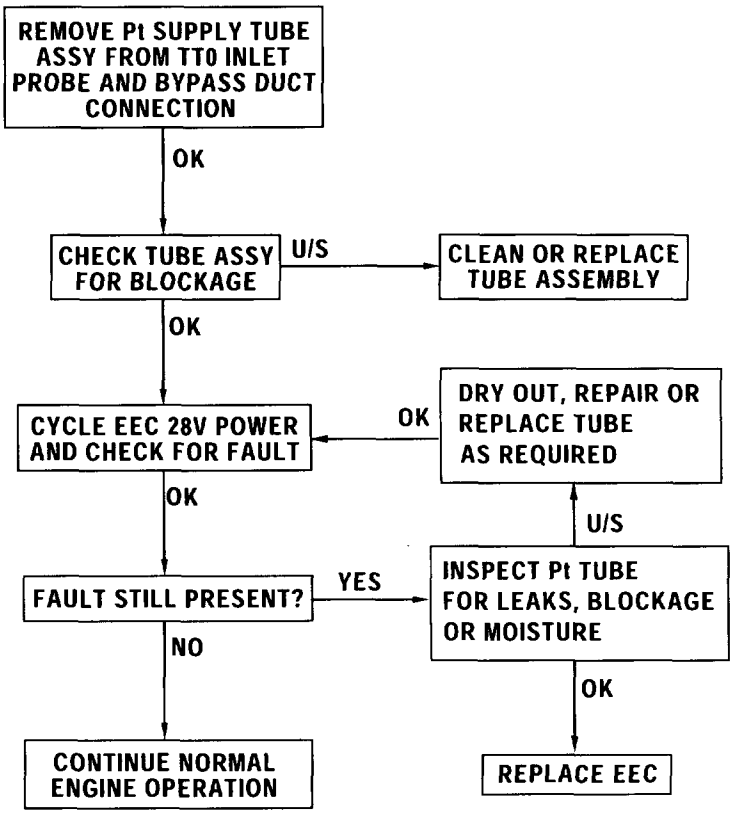
Post-SB24434/Pre-SB24514 C63840

MFD Codes with LRU Prefix G
Figure 107 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
HB	EEC Pt RATE OR RANGE	0

EFFECTS ON SYSTEM - POSSIBLE REDUCTION IN ENGINE THRUST IF ADC IS LOST.
- EEC CONTROLS ON SYNTHESIZED Pt AS A FUNCTION OF CORRECTED N2 AND AMBIENT AIR PRESSURE IF ADC IS LOST.
- LOSS OF N1 BUG INDICATION IF MFD CODES HB AND RB OR RA OCCUR TOGETHER. IN THIS CASE, THE FAULT BECOMES 1.

CORRECTIVE ACTION



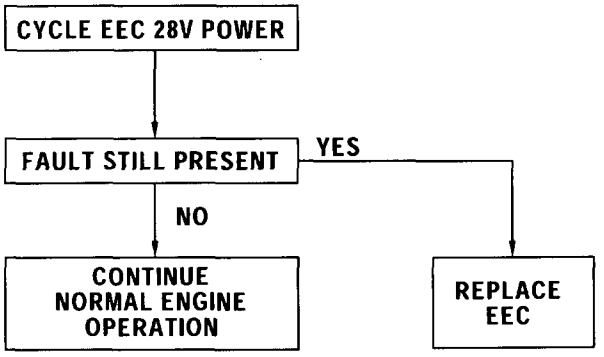
Post-SB24434/Pre-SB24514 C32910E

MFD Codes with LRU Prefix H
Figure 108

MFD CODE	FAULT	FAULT LEVEL
JB	EEC PAMB RATE OR RANGE	0

EFFECTS ON SYSTEM - POSSIBLE REDUCTION IN ENGINE THRUST IF ADC IS LOST.
- EEC CONTROLS ON SYNTHESIZED PAMB AS A FUNCTION OF CORRECTED N2 AND TOTAL INLET AIR PRESSURE IF ADC IS LOST.
- LOSS OF N1 BUG INDICATION IF MFD CODES JB AND RC OR RA OCCUR TOGETHER . IN THIS CASE, THE FAULT LEVEL BECOMES 2.

CORRECTIVE ACTION



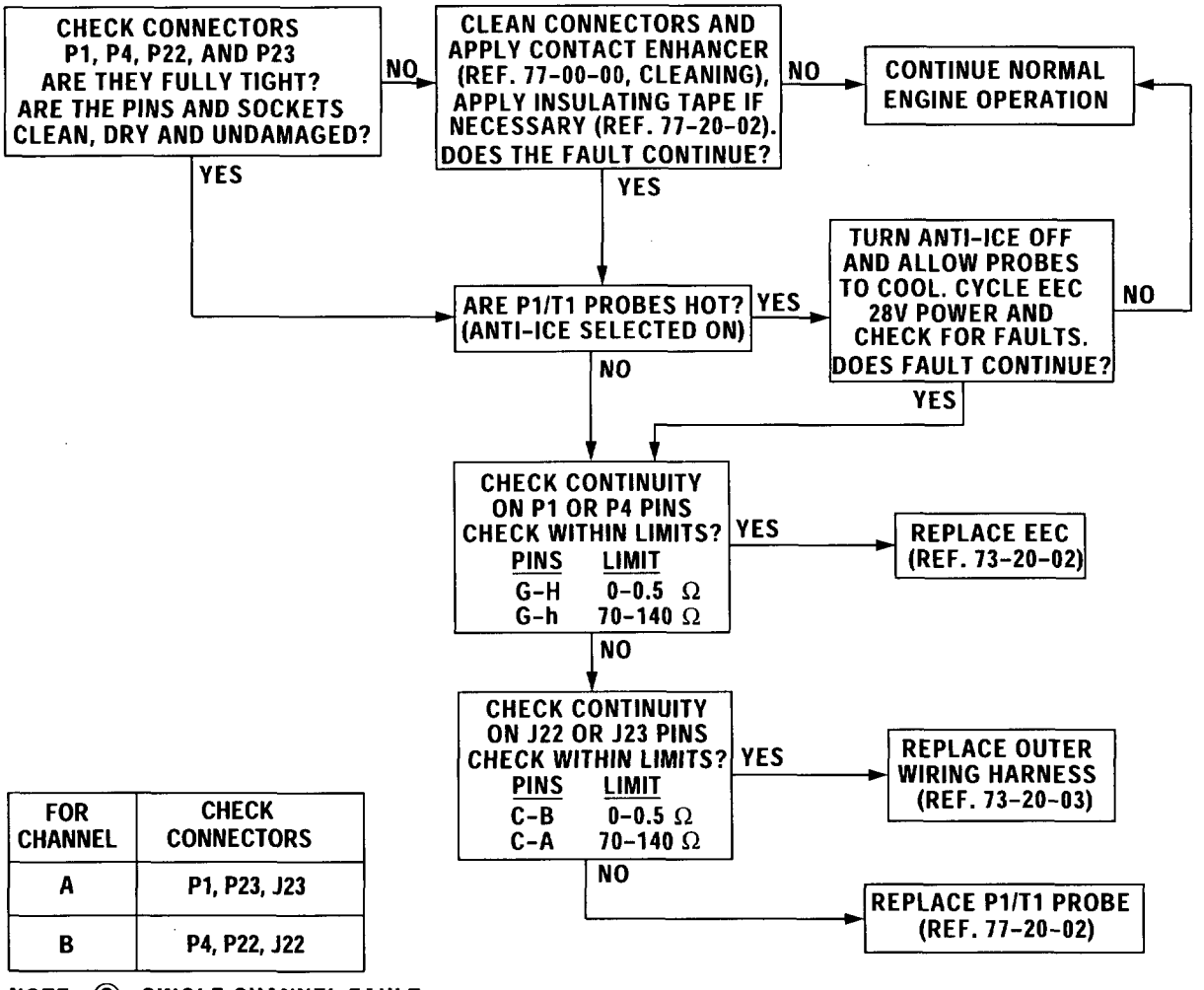
Post-SB24434/Pre-SB24514 C32912D

MFD Codes with LRU Prefix J
Figure 109

MFD CODE	FAULT	FAULT LEVEL
KB	TT0 RATE OR RANGE	0

EFFECTS ON SYSTEM - Ⓢ EEC DEFAULTS TO AIR DATA COMPUTER TT0
- Ⓢ POSSIBLE ENGINE THRUST CHANGE DUE TO DIFFERENCE BETWEEN ENGINE TT0 AND AIR DATA COMPUTER TT0
- Ⓢ POSSIBLE CHANGE IN ENGINE ACCEL AND DECEL RATES
- LOSS OF N1 BUG INDICATION IF MFD CODES KB AND RD OR RA OCCUR TOGETHER. IN THIS CASE, FAULT LEVEL BECOMES 2.

CORRECTIVE ACTION


CHECK CONNECTORS P1, P4, P22, AND P23 ARE THEY FULLY TIGHT? ARE THE PINS AND SOCKETS CLEAN, DRY AND UNDAMAGED?
NO
CLEAN CONNECTORS AND APPLY CONTACT ENHANCER (REF. 77-00-00, CLEANING), APPLY INSULATING TAPE IF NECESSARY (REF. 77-20-02). DOES THE FAULT CONTINUE?
NO
CONTINUE NORMAL ENGINE OPERATION
YES
YES
ARE P1/T1 PROBES HOT? (ANTI-ICE SELECTED ON)
YES
TURN ANTI-ICE OFF AND ALLOW PROBES TO COOL. CYCLE EEC 28V POWER AND CHECK FOR FAULTS. DOES FAULT CONTINUE?
NO
YES
NO
CHECK CONTINUITY ON P1 OR P4 PINS CHECK WITHIN LIMITS?
PINS LIMIT
G-H 0-0.5 Ω
G-h 70-140 Ω
YES
REPLACE EEC (REF. 73-20-02)
NO
CHECK CONTINUITY ON J22 OR J23 PINS CHECK WITHIN LIMITS?
PINS LIMIT
C-B 0-0.5 Ω
C-A 70-140 Ω
YES
REPLACE OUTER WIRING HARNESS (REF. 73-20-03)
NO
REPLACE P1/T1 PROBE (REF. 77-20-02)

FOR CHANNEL	CHECK CONNECTORS
A	P1, P23, J23
B	P4, P22, J22

NOTE: Ⓢ= SINGLE CHANNEL FAULT

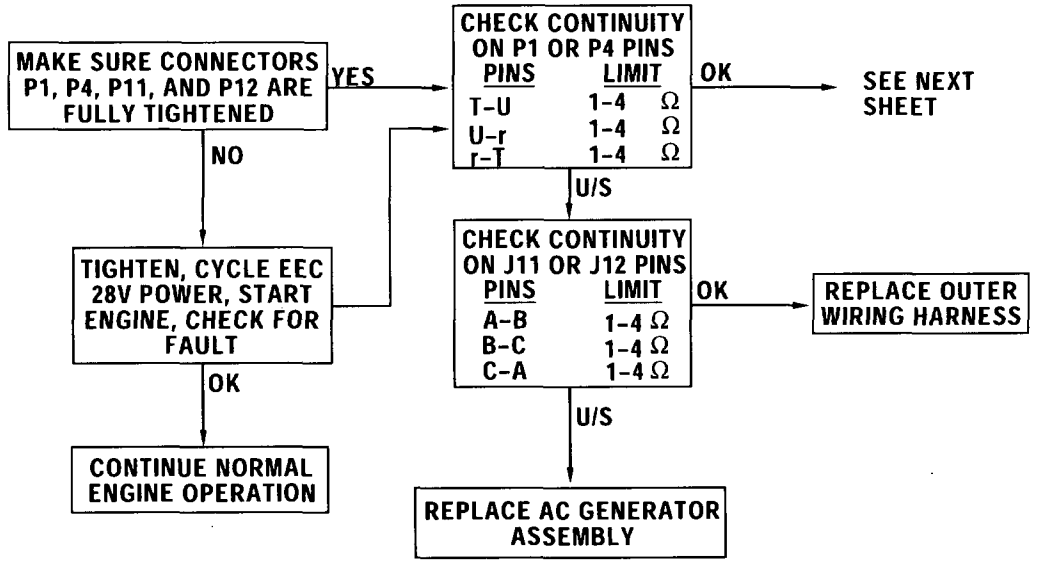
Post-SB24434/Pre-SB24514 C62173B

MFD Codes with LRU Prefix K
Figure 110

MFD CODE	FAULT	FAULT LEVEL
LA	PMA VOLTAGE FAULT	2

EFFECTS ON SYSTEM - Ⓢ LOSS OF EEC AC GENERATOR VOLTAGE SUPPLY
- Ⓢ EEC SWITCHES TO 28 VDC AIRCRAFT SUPPLY
- Ⓢ EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION

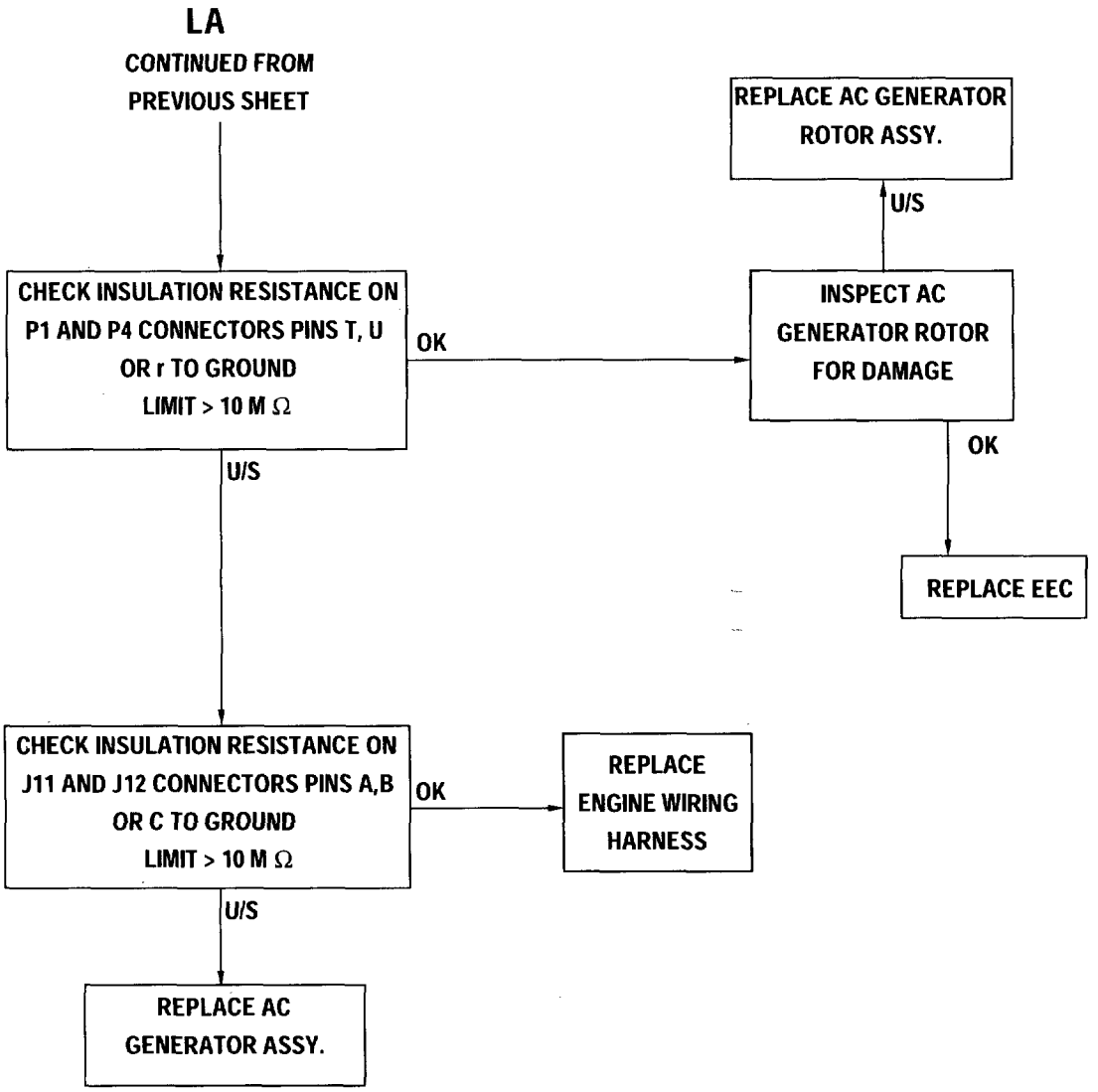


FOR CHANNEL	CHECK CONNECTORS
A	P1,J11
B	P4,J12

NOTE: Ⓢ= SINGLE CHANNEL FAULT

Post-SB24434/Pre-SB24514 C62174A

MFD Codes with LRU Prefix L
Figure 111 (Sheet 1 of 3)



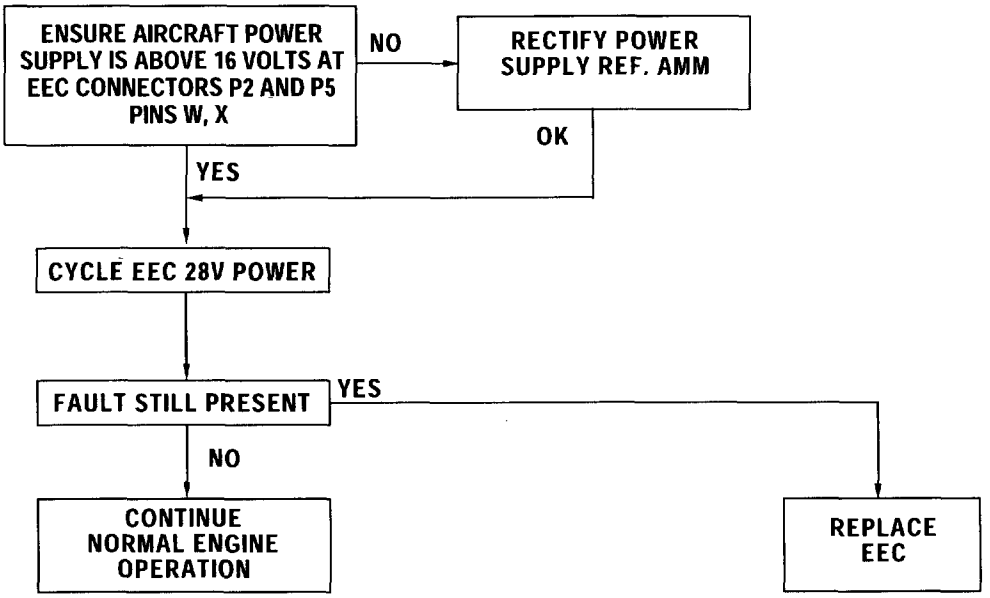
Post-SB24434/Pre-SB24514 C63215A

MFD Codes with LRU Prefix L
Figure 111 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
LB	LOW AIRCRAFT VOLTAGE	0

EFFECTS ON SYSTEM - Ⓢ EEC DETECTS LOW AIRCRAFT VOLTAGE DURING START
- NO FAULT LAMP INDICATION WITH THIS CODE
- IF IT OCCURS DURING START, START MAY NOT BE SUCCESSFUL

CORRECTIVE ACTION



NOTE: Ⓢ= SINGLE CHANNEL FAULT

Post-SB24434/Pre-SB24514 C61765A

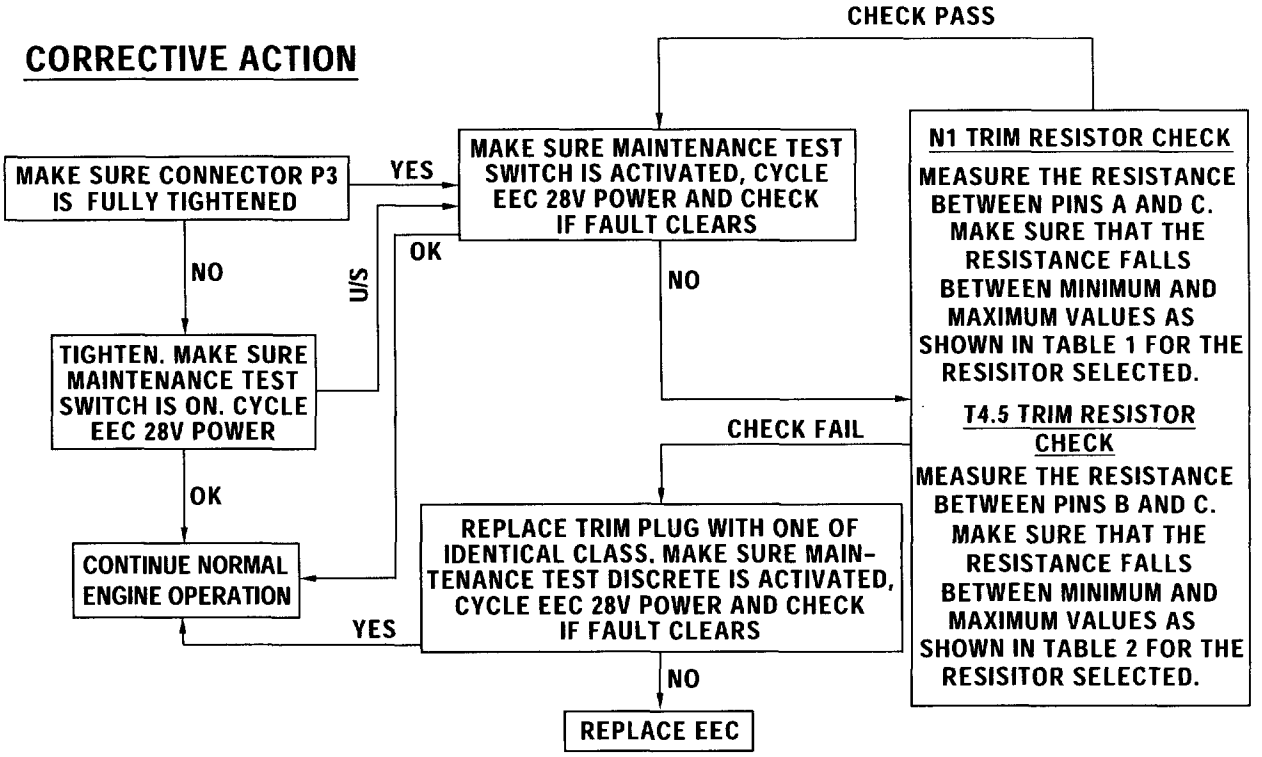
MFD Codes with LRU Prefix L
Figure 111 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
MA	INVALID TRIM PLUG STATE	1 OR 2
MC	TRIM PLUG NOT THE SAME AS TRIM PLUG IMAGE	1

EFFECTS ON SYSTEM - **MA** – Ⓢ EEC DOES NOT RECOGNIZE TRIM PLUG INPUT CONFIGURATION
EEC USES DEFAULT TRIMS IN EEPROM FROM PREVIOUS VALID TRIM PLUG INPUT
NO EEC CHANNEL SWITCHOVER
INCORRECT POWER SETTING AND T45 LIMITING / INDICATION

MC – EEC DOES NOT RECOGNIZE TRIM PLUG COMPARED TO EEROM IMAGE
EEC USES DEFAULT TRIMS IN EEPROM FROM PREVIOUS VALID TRIM PLUG INPUT
NO EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION


CHECK PASS
MAKE SURE CONNECTOR P3 IS FULLY TIGHTENED
YES
MAKE SURE MAINTENANCE TEST SWITCH IS ACTIVATED, CYCLE EEC 28V POWER AND CHECK IF FAULT CLEARS
N1 TRIM RESISTOR CHECK
MEASURE THE RESISTANCE BETWEEN PINS A AND C. MAKE SURE THAT THE RESISTANCE FALLS BETWEEN MINIMUM AND MAXIMUM VALUES AS SHOWN IN TABLE 1 FOR THE RESISITOR SELECTED.
NO
U/S
OK
NO
TIGHTEN. MAKE SURE MAINTENANCE TEST SWITCH IS ON. CYCLE EEC 28V POWER
CHECK FAIL
T4.5 TRIM RESISTOR CHECK
MEASURE THE RESISTANCE BETWEEN PINS B AND C. MAKE SURE THAT THE RESISTANCE FALLS BETWEEN MINIMUM AND MAXIMUM VALUES AS SHOWN IN TABLE 2 FOR THE RESISITOR SELECTED.
OK
CONTINUE NORMAL ENGINE OPERATION
REPLACE TRIM PLUG WITH ONE OF IDENTICAL CLASS. MAKE SURE MAINTENANCE TEST DISCRETE IS ACTIVATED, CYCLE EEC 28V POWER AND CHECK IF FAULT CLEARS
YES
NO
REPLACE EEC

NOTE: Ⓢ = SINGLE CHANNEL FAULT

Post-SB24434/Pre-SB24514 C128155

MFD Codes with LRU Prefix M
Figure 112 (Sheet 1 of 6)

MC - CONTINUED FROM SHEET 1

TABLE 1. N1 TRIM RESISTOR VALUES

TRIM CLASS	RESISTOR PART NUMBER	RESISTOR VALUE (Ω)	
		MIN.	MAX.
CL0	ST3090 - 82	613	625
CL1	ST3090 - 74	1485	1515
CL2	ST3090 - 66	2643	2697
CL3	ST3090 - 110	4227	4313
CL4	ST3090 - 34	6504	6636
CL5	ST3090 - 102	10098	10302
CL6	ST3090 - 96	16533	16867
CL7	ST3090 - 91	32076	32724

Post-SB24434/Pre-SB24514 C128156

MFD Codes with LRU Prefix M
Figure 112 (Sheet 2)

MC - CONTINUED FROM SHEET 2

TABLE 2. T4.5 TRIM RESISTOR VALUES

TRIM CLASS	T4.5 TRIM VALUE (DEG.C.)	RESISTOR PART NUMBER	RESISTOR VALUE (Ω)	
			MIN.	MAX.
CL00	0.0	ST3090 - 82	613	625
CL01	3.0	ST3090 - 80	808	824
CL02	6.0	ST3090 - 78	1030	1050
CL03	9.0	ST3090 - 76	1257	1283
CL04	12.0	ST3090 - 74	1485	1515
CL05	15.0	ST3090 -72	1762	1798
CL06	18.0	ST3090 -70	2030	2071
CL07	21.0	ST3090 - 68	2317	2363
CL08	24.0	ST3090 - 66	2643	2697
CL09	27.0	ST3090 - 64	2980	3040
CL10	30.0	ST3090 - 57	3366	3424
CL11	33.0	ST3090 - 53	3792	3868
CL12	36.0	ST3090 - 110	4227	4313
CL13	39.0	ST3090 -108	4703	4798
CL14	42.0	ST3090 - 42	5247	5353
CL15	45.0	ST3090 - 37	5841	5959
CL16	48.0	ST3090 - 34	6504	6636

Post-SB24434/Pre-SB24514 C128157

MFD Codes with LRU Prefix M
Figure 112 (Sheet 3)

MC - CONTINUED FROM SHEET 3

TABLE 2. T4.5 TRIM RESISTOR VALUES (CONT'D)

TRIM CLASS	T45 TRIM VALUE (DEG.C.)	RESISTOR PART NUMBER	RESISTOR VALUE (Ω)	
			MIN.	MAX.
CL17	51.0	ST3090 - 107	7247	7393
CL18	54.0	ST3090 - 27	8078	8242
CL19	57.0	ST3090 - 104	8999	9181
CL20	60.0	ST3090 - 102	10098	10302
CL21	63.0	ST3090 - 100	11385	11615
CL22	66.0	ST3090 - 16	12870	13130
CL23	69.0	ST3090 - 97	14553	14847
CL24	72.0	ST3090 - 96	16533	16867
CL25	75.0	ST3090 - 10	19107	19493
CL26	78.0	ST3090 - 93	22374	22826
CL27	81.0	ST3090 - 92	26433	26967
CL28	84.0	ST3090 - 91	32076	32724
CL29	87.0	ST3090 - 89	39798	40602
CL30	90.0	ST3090 - 87	51777	52823

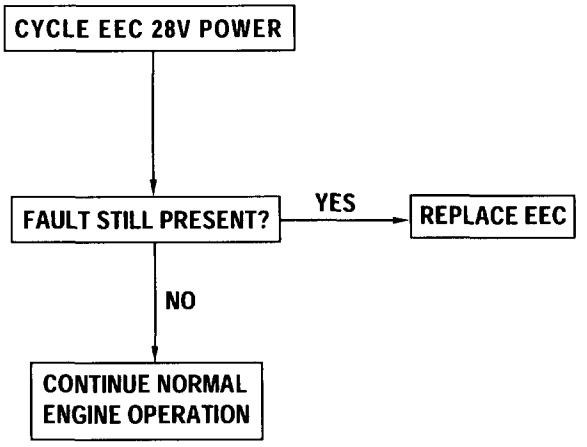
Post-SB24434/Pre-SB24514 C128158

MFD Codes with LRU Prefix M
Figure 112 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
MB	INVALID EEROM TRIM PLUG IMAGE	0

EFFECTS ON SYSTEM - EEC USES VALID TRIM PLUG INPUT
NO EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION



Post-SB24434/Pre-SB24514

C32918C

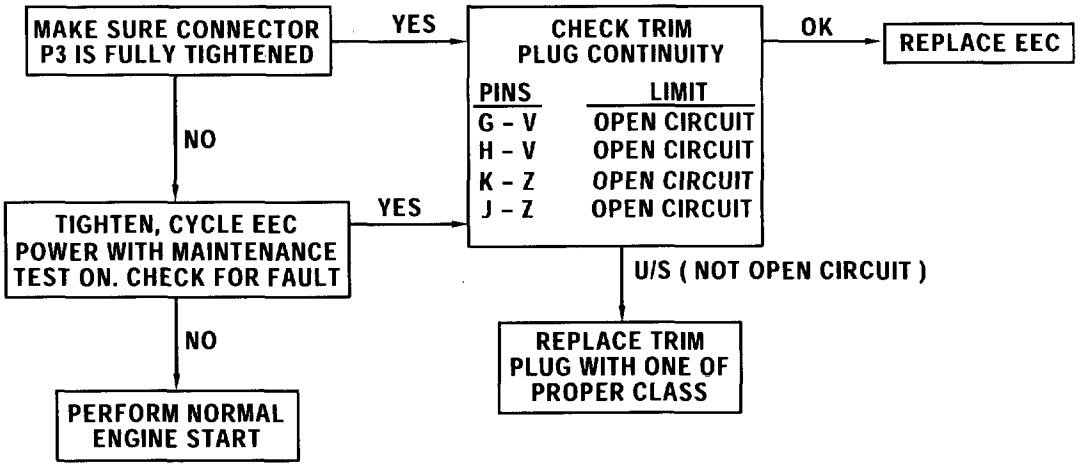
MFD Codes with LRU Prefix M
Figure 112 (Sheet 5)

MFD CODE	FAULT	FAULT LEVEL
MD PW305B ONLY	ENGINE/EEC STANDARDS INCOMPATIBLE	2

EFFECTS ON SYSTEM - SOFTWARE TEMPERATURE LIMITS DIFFERENT FROM HARDWARE TEMPERATURE LIMITS.

- DAMAGE TO ENGINE MAY RESULT.

CORRECTIVE ACTION



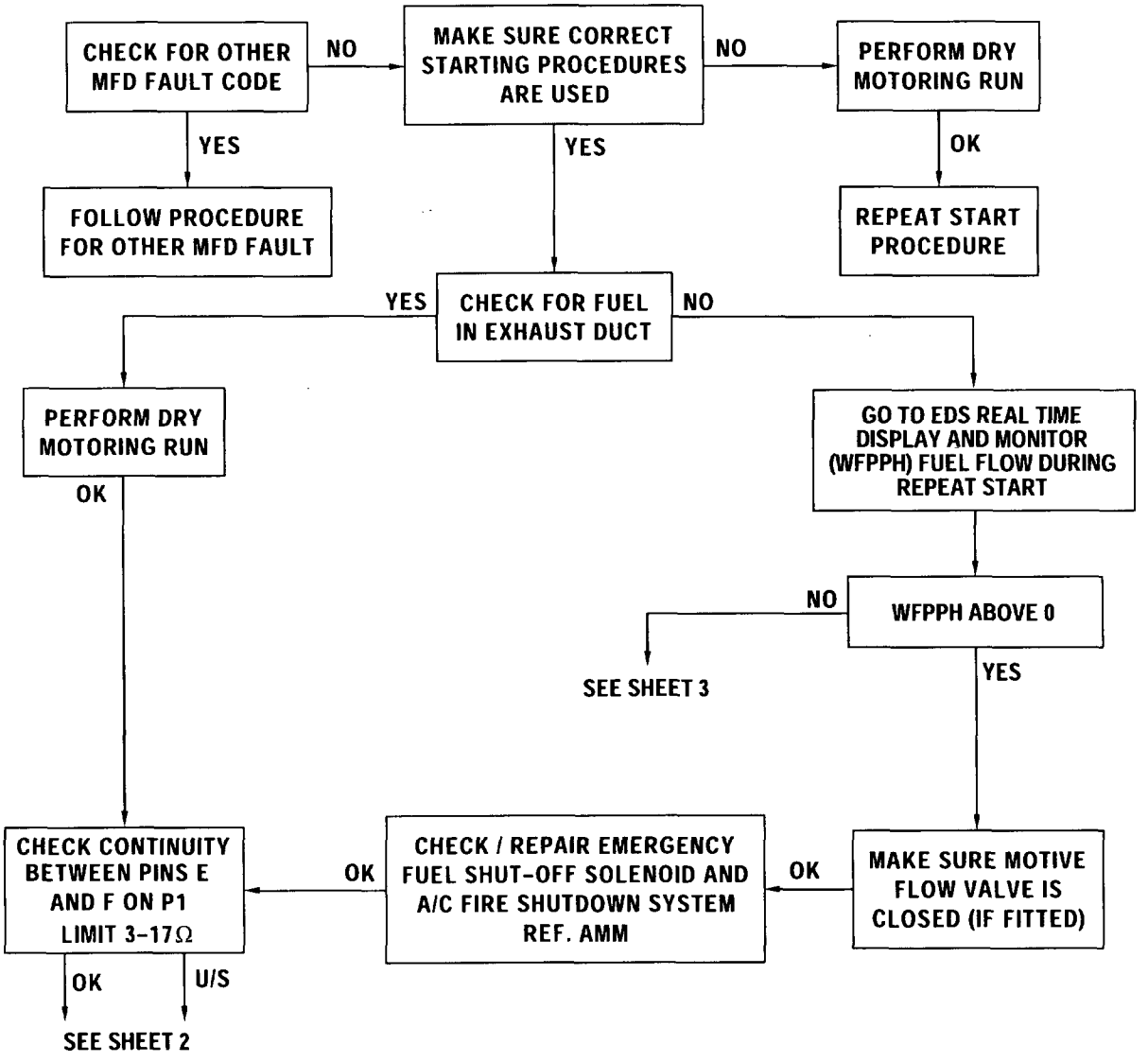
Post-SB24434/Pre-SB24514 C33165B

MFD Codes with LRU Prefix M
Figure 112 (Sheet 6)

MFD CODE	FAULT	FAULT LEVEL
NC	ENGINE LIGHT UP FAIL	2

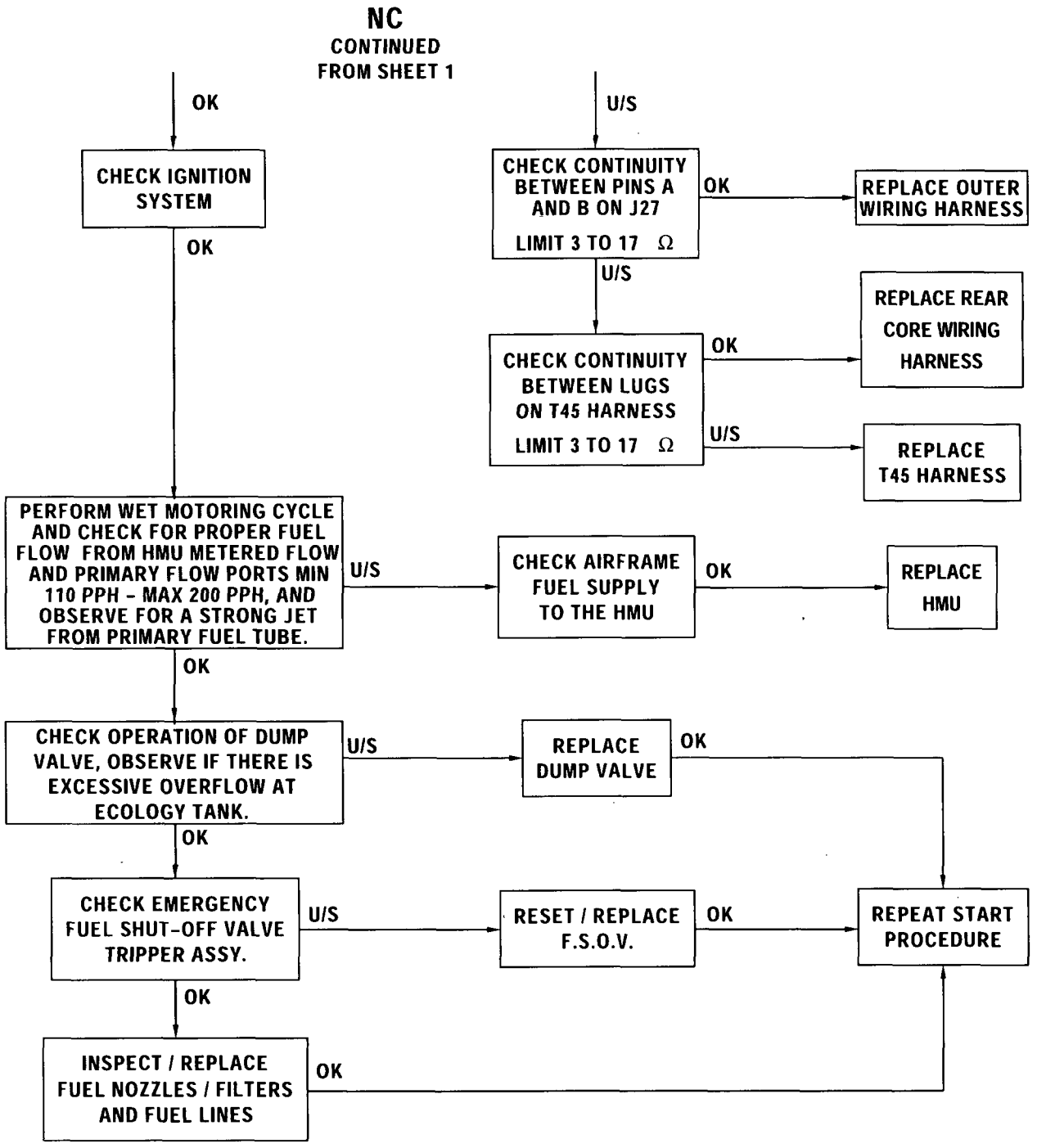
EFFECTS ON SYSTEM - ABORTED START DUE TO LOW T45 (ITT) 15 SECONDS AFTER FUEL-ON.

CORRECTIVE ACTION



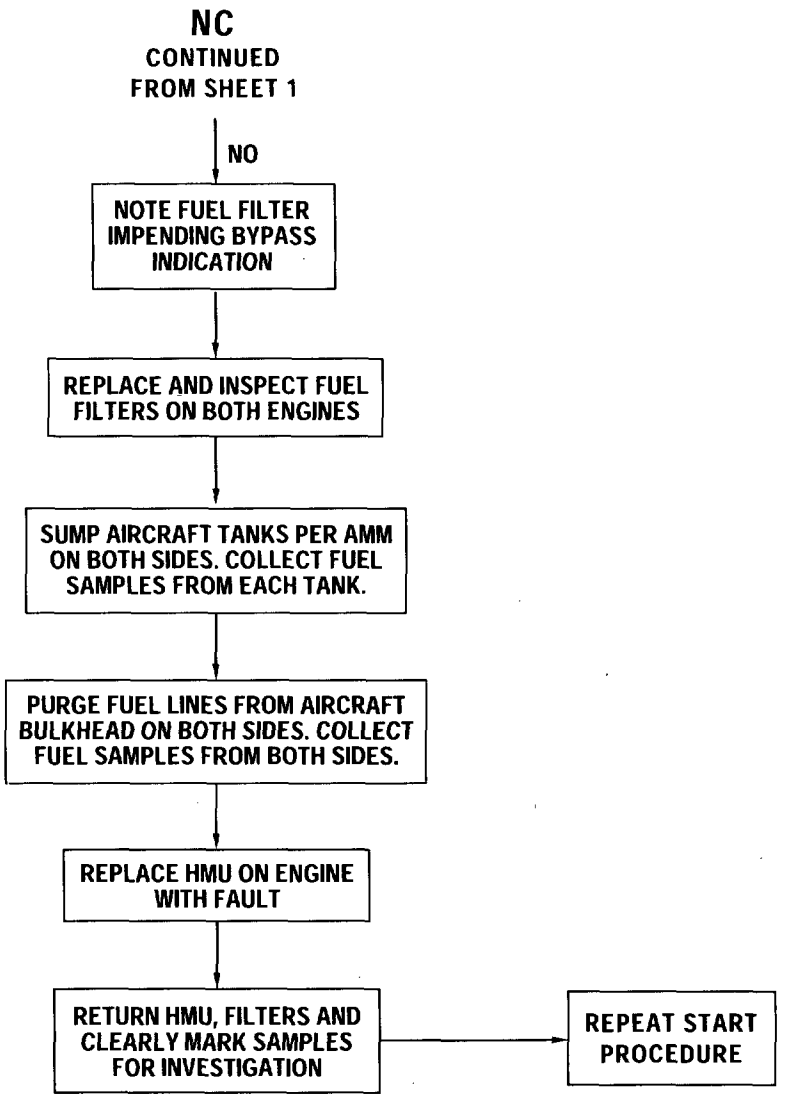
Post-SB24434/Pre-SB24514 C62175B

MFD Codes with LRU Prefix N
Figure 113 (Sheet 1 of 4)


NC
CONTINUED
FROM SHEET 1
OK
CHECK IGNITION SYSTEM
OK
U/S
CHECK CONTINUITY BETWEEN PINS A AND B ON J27
LIMIT 3 TO 17 Ω
OK
REPLACE OUTER WIRING HARNESS
U/S
CHECK CONTINUITY BETWEEN LUGS ON T45 HARNESS
LIMIT 3 TO 17 Ω
OK
REPLACE REAR CORE WIRING HARNESS
U/S
REPLACE T45 HARNESS
PERFORM WET MOTORING CYCLE AND CHECK FOR PROPER FUEL FLOW FROM HMU METERED FLOW AND PRIMARY FLOW PORTS MIN 110 PPH - MAX 200 PPH, AND OBSERVE FOR A STRONG JET FROM PRIMARY FUEL TUBE.
U/S
CHECK AIRFRAME FUEL SUPPLY TO THE HMU
OK
REPLACE HMU
OK
CHECK OPERATION OF DUMP VALVE, OBSERVE IF THERE IS EXCESSIVE OVERFLOW AT ECOLOGY TANK.
U/S
REPLACE DUMP VALVE
OK
OK
CHECK EMERGENCY FUEL SHUT-OFF VALVE TRIPPER ASSY.
U/S
RESET / REPLACE F.S.O.V.
OK
REPEAT START PROCEDURE
OK
INSPECT / REPLACE FUEL NOZZLES / FILTERS AND FUEL LINES
OK

Post-SB24434/Pre-SB24514 C33723B

MFD Codes with LRU Prefix N
Figure 113 (Sheet 2)


NC
CONTINUED
FROM SHEET 1
NO
NOTE FUEL FILTER IMPENDING BYPASS INDICATION
REPLACE AND INSPECT FUEL FILTERS ON BOTH ENGINES
SUMP AIRCRAFT TANKS PER AMM ON BOTH SIDES. COLLECT FUEL SAMPLES FROM EACH TANK.
PURGE FUEL LINES FROM AIRCRAFT BULKHEAD ON BOTH SIDES. COLLECT FUEL SAMPLES FROM BOTH SIDES.
REPLACE HMU ON ENGINE WITH FAULT
RETURN HMU, FILTERS AND CLEARLY MARK SAMPLES FOR INVESTIGATION
REPEAT START PROCEDURE

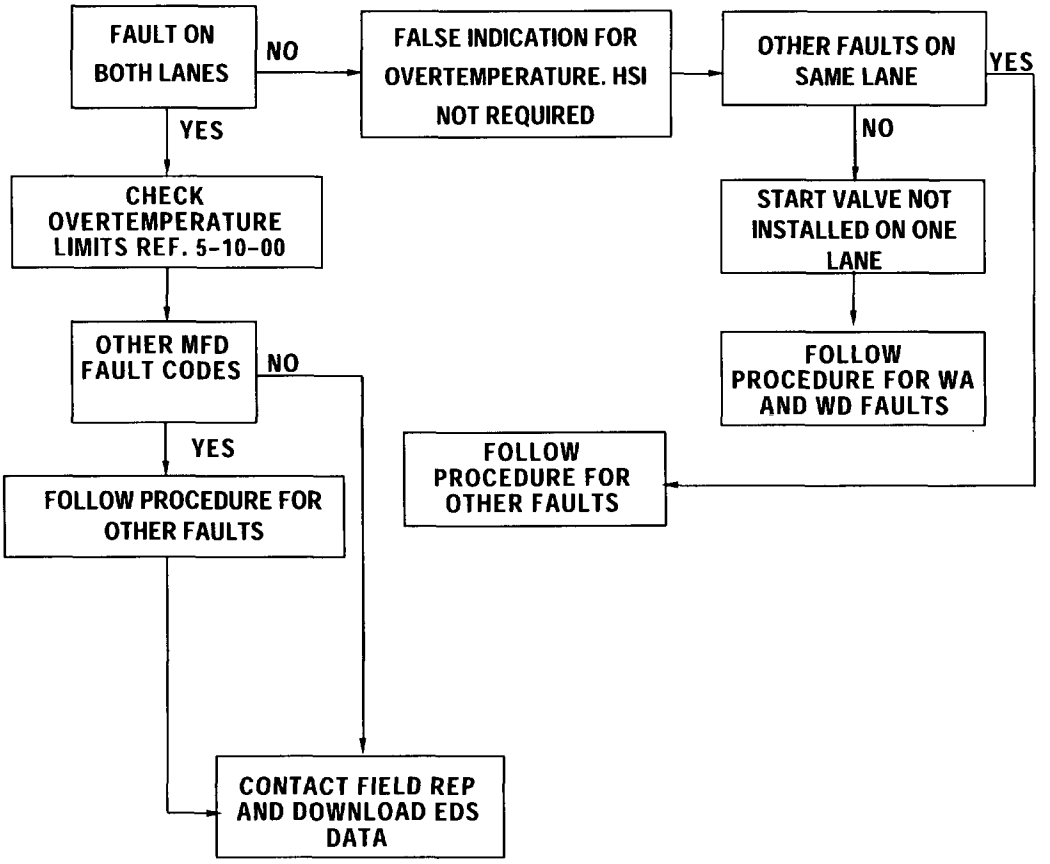
Post-SB24434/Pre-SB24514 C69868

MFD Codes with LRU Prefix N
Figure 113 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
ND	T45 START LIMIT EXCEEDED	2

EFFECTS ON SYSTEM - ATTEMPTED ENGINE START FOLLOWED BY AN ABORTED START DUE TO HIGH T45 (ITT) INDICATION
- ENGINE SHUT DOWN

CORRECTIVE ACTION



Post-SB24434/Pre-SB24514 C62179B

MFD Codes with LRU Prefix N
Figure 113 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
PB	N1R RATE OR RANGE	1

EFFECTS ON SYSTEM - Ⓢ ATTCS TRIGGER WOULD BE BASED ON N2R ONLY.
- Ⓢ LOSS OF SYNCHRONIZATION.

CORRECTIVE ACTION

NOTE: PRIOR TO REMOVING HARDWARE FLEX N1 SPEED PROBE CABLE AND RECHECK RESISTANCE / CONTINUITY.

MAKE SURE CONNECTORS P2 OF FAULTY ENGINE AND P6, P28 OF REMOTE ENGINE HAVE NO BENT PINS AND CONNECTORS ARE FULLY TIGHTENED

YES → DISCONNECT THE P2 CONNECTOR AND MEASURE THE CONTINUITY FROM PIN AA TO PIN BB
LIMITS: PRE-SB24546 570-840 Ω
LIMITS: POST-SB24546 125-200 Ω
MEASURE INSULATION RESISTANCE FROM THE SAME PINS TO GROUND
LIMIT ≥ 10 MEG Ω
ARE THEY SATISFACTORY?

YES → COMPLETE THE EEC RETURN SHEET AND REPLACE THE EEC (REF. 73-20-02)

NO → TIGHTEN CYCLE EEC 28V POWER AND CHECK FOR FAULT

YES → (DISCONNECT THE P2 CONNECTOR ...)

NO → CONTINUE NORMAL ENGINE OPERATION

NO → MEASURE THE CONTINUITY AT J6 ON THE REMOTE ENGINE FROM PIN P TO PIN N
LIMITS: PRE-SB24546 570-840 Ω
LIMITS: POST-SB24546 125-200 Ω
MEASURE INSULATION RESISTANCE FROM THE SAME PINS TO GROUND
LIMIT ≥ 10 MEG Ω
ARE THEY SATISFACTORY?

YES → INVESTIGATE AIRFRAME WIRING FROM P6 TO P2 (REF. AMM)

NO → MEASURE THE CONTINUITY AT J28 ON THE REMOTE ENGINE FROM PIN G TO PIN H
LIMITS: PRE-SB24546 570-840 Ω
LIMITS: POST-SB24546 125-200 Ω
MEASURE INSULATION RESISTANCE FROM THE SAME PINS TO GROUND
LIMIT ≥ 10 MEG Ω
ARE THEY SATISFACTORY?

YES → REPLACE THE OUTER WIRING HARNESS ON REMOTE ENGINE (REF. 73-20-03)

NO → DISCONNECT THE REMOTE ENGINE'S CHANNEL B N1 SENSOR AT THE TERMINAL BOX (REF. 77-20-01) AND MEASURE CONTINUITY FROM THE RED LEAD TO BLUE LEAD
LIMITS: PRE-SB24546 570-840Ω , POST-SB24546 125-200Ω
MEASURE INSULATION RESISTANCE FROM ORANGE TO BROWN, AND ORANGE TO RED, AND BROWN TO RED, AND FROM ALL LEADS INDIVIDUALLY TO GROUND.
LIMIT ≥ 10 MEGΩ. ARE THEY SATISFACTORY?

CONTINUED ON SHEET 2

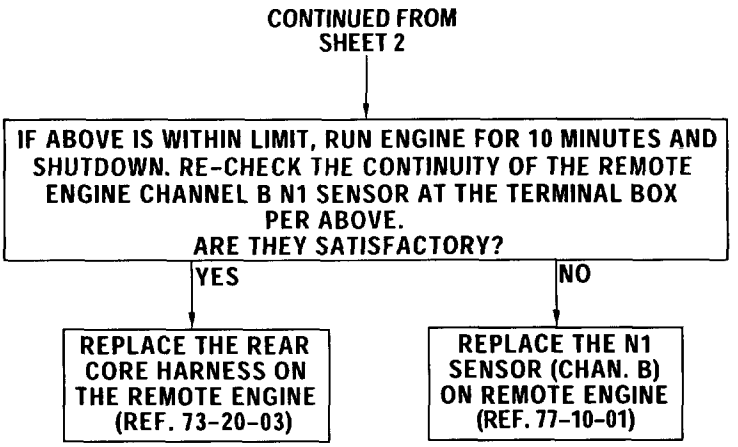
FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P2

FOR CHANNEL	CHECK CONNECTORS OF REMOTE ENGINE
A	J6, J28
B	J6, J28

NOTE: Ⓢ= SINGLE CHANNEL FAULT

Post-SB24434/Pre-SB24514 C63468E

MFD Codes with LRU Prefix P
Figure 114 (Sheet 1 of 4)


CONTINUED FROM
SHEET 2
IF ABOVE IS WITHIN LIMIT, RUN ENGINE FOR 10 MINUTES AND SHUTDOWN. RE-CHECK THE CONTINUITY OF THE REMOTE ENGINE CHANNEL B N1 SENSOR AT THE TERMINAL BOX PER ABOVE.
ARE THEY SATISFACTORY?
YES
NO
REPLACE THE REAR CORE HARNESS ON THE REMOTE ENGINE (REF. 73-20-03)
REPLACE THE N1 SENSOR (CHAN. B) ON REMOTE ENGINE (REF. 77-10-01)

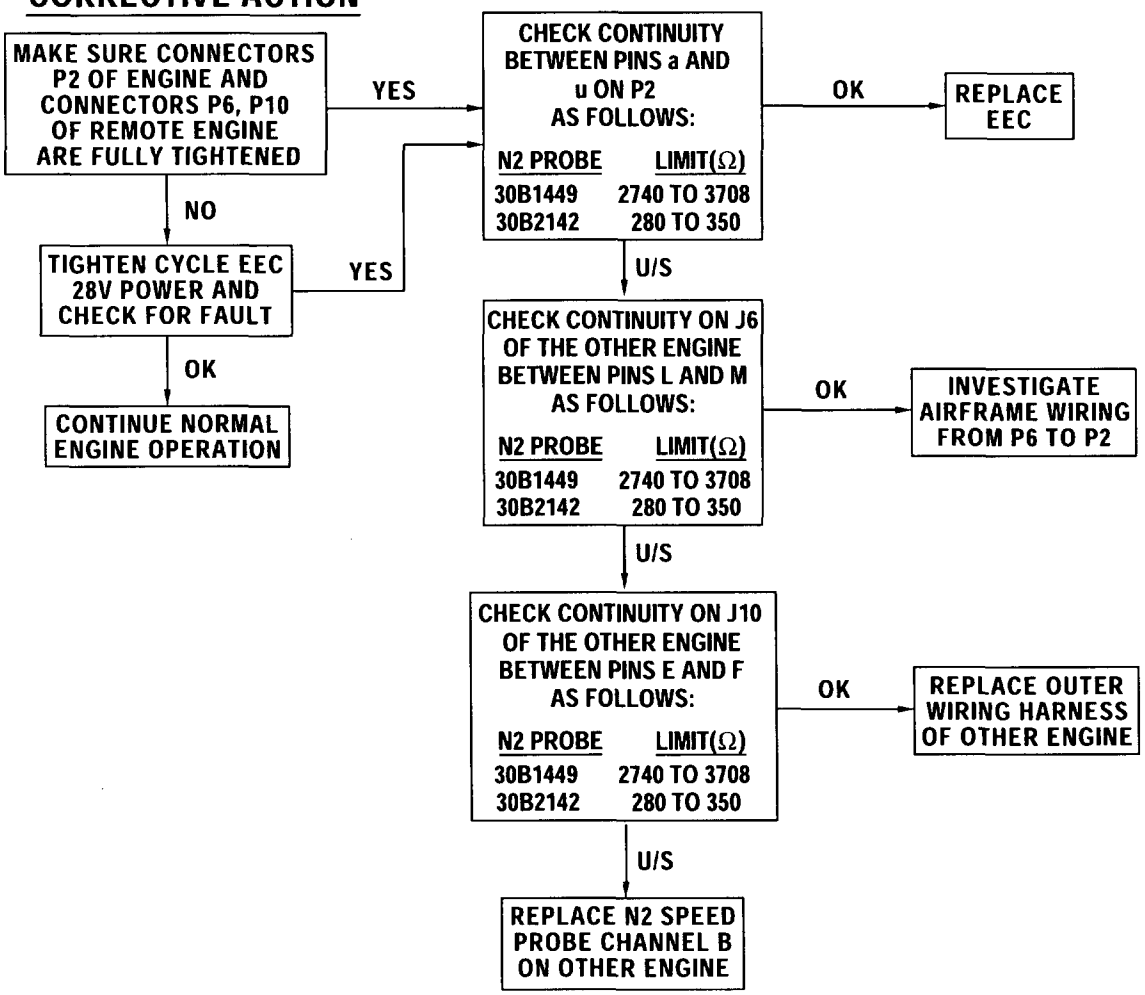
Post-SB24434/Pre-SB24514 C150410

MFD Codes with LRU Prefix P
Figure 114 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
PD	N2R RATE OR RANGE	1

EFFECTS ON SYSTEM - ATTCS TRIGGER WOULD BE BASED ON N1R ONLY
- LOSS OF SYNCHRONIZATION.

CORRECTIVE ACTION


MAKE SURE CONNECTORS P2 OF ENGINE AND CONNECTORS P6, P10 OF REMOTE ENGINE ARE FULLY TIGHTENED
YES
NO
TIGHTEN CYCLE EEC 28V POWER AND CHECK FOR FAULT
YES
OK
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY BETWEEN PINS a AND u ON P2 AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 2740 TO 3708
30B2142 280 TO 350
OK
REPLACE EEC
U/S
CHECK CONTINUITY ON J6 OF THE OTHER ENGINE BETWEEN PINS L AND M AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 2740 TO 3708
30B2142 280 TO 350
OK
INVESTIGATE AIRFRAME WIRING FROM P6 TO P2
U/S
CHECK CONTINUITY ON J10 OF THE OTHER ENGINE BETWEEN PINS E AND F AS FOLLOWS:
N2 PROBE LIMIT(Ω)
30B1449 2740 TO 3708
30B2142 280 TO 350
OK
REPLACE OUTER WIRING HARNESS OF OTHER ENGINE
U/S
REPLACE N2 SPEED PROBE CHANNEL B ON OTHER ENGINE

Post-SB24434/Pre-SB24514 C32926D

MFD Codes with LRU Prefix P
Figure 114 (Sheet 3)

DELETED

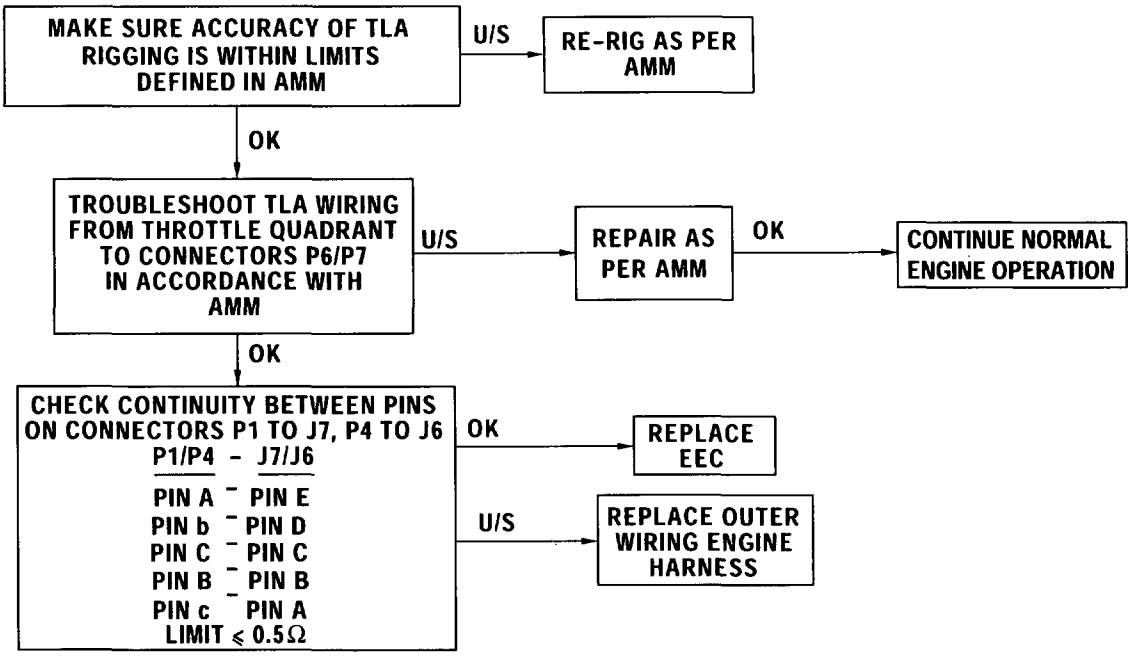
Post-SB24434/Pre-SB24514 C00000

MFD Codes with LRU Prefix P
Figure 114 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
QB	TLA RATE OR RANGE	3

EFFECTS ON SYSTEM - Ⓓ THROTTLE LEVER POSITION EXCEEDS NORMAL OPERATING RATE OR RANGE
- Ⓓ TLA DEFAULTS TO IDLE POSITION.
- Ⓓ ENGINE DOES NOT RESPOND TO TLA MOVEMENT.
- Ⓓ ENGINE REMAINS AT IDLE.
- Ⓢ USES OTHER CHANNEL'S TLA INPUT.
- Ⓓ LOSS OF N1 BUG INDICATION.

CORRECTIVE ACTION


MAKE SURE ACCURACY OF TLA RIGGING IS WITHIN LIMITS DEFINED IN AMM
U/S
RE-RIG AS PER AMM
OK
TROUBLESHOOT TLA WIRING FROM THROTTLE QUADRANT TO CONNECTORS P6/P7 IN ACCORDANCE WITH AMM
U/S
REPAIR AS PER AMM
OK
CONTINUE NORMAL ENGINE OPERATION
OK
CHECK CONTINUITY BETWEEN PINS ON CONNECTORS P1 TO J7, P4 TO J6
P1/P4 - J7/J6
PIN A - PIN E
PIN b - PIN D
PIN C - PIN C
PIN B - PIN B
PIN c - PIN A
LIMIT ≤ 0.5Ω
OK
REPLACE EEC
U/S
REPLACE OUTER WIRING ENGINE HARNESS

FOR CHANNEL	CHECK CONNECTORS
A	P1, J7
B	P4, J6

NOTE: Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

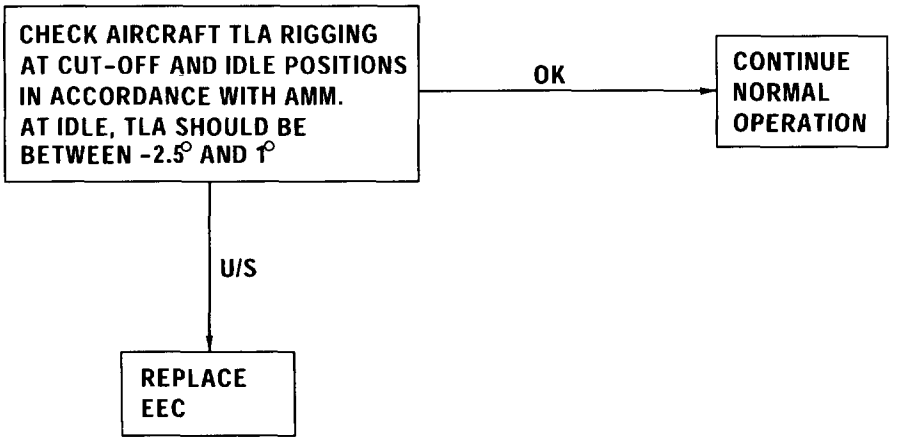
Post-SB24434/Pre-SB24514 C62181A

MFD Codes with LRU Prefix Q
Figure 115 (Sheet 1 of 5)

MFD CODE	FAULT	FAULT LEVEL
QC (POST-SB24337)	TLA RIGGING OR IN-RANGE FAULT	1

EFFECTS ON SYSTEM : Ⓓ TLA DEFAULTS TO IDLE POSITION
Ⓓ ENGINE REMAINS AT IDLE

CORRECTIVE ACTION


CHECK AIRCRAFT TLA RIGGING AT CUT-OFF AND IDLE POSITIONS IN ACCORDANCE WITH AMM. AT IDLE, TLA SHOULD BE BETWEEN -2.5° AND 1°
OK
CONTINUE NORMAL OPERATION
U/S
REPLACE EEC

NOTE: FAULT CODE QC SIGNALS THAT THE TLA OR RVDT HAS DRIFTED TOWARDS CUT-OFF TO THE TLA REGION OF -2.5° TO -4°

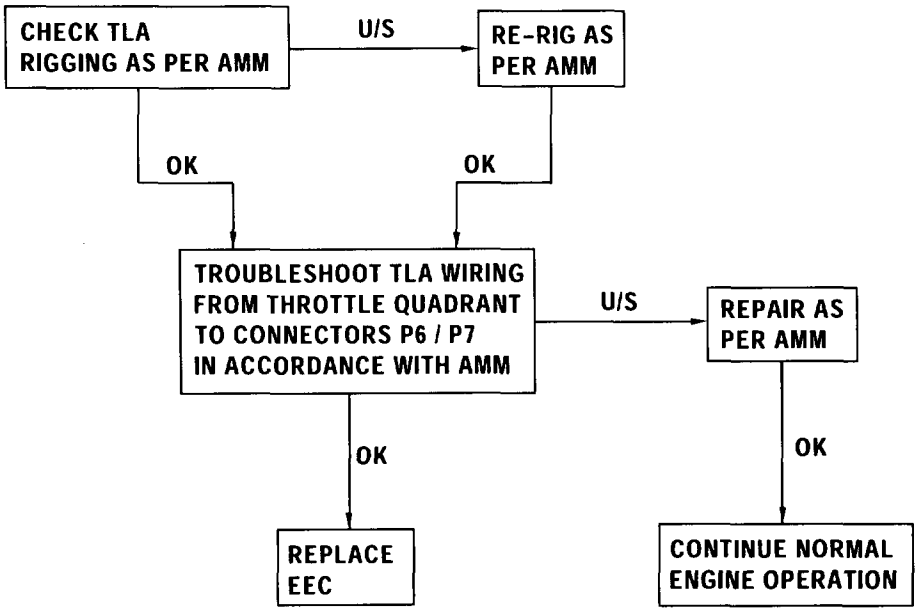
Post-SB24434/Pre-SB24514 C25660

MFD Codes with LRU Prefix Q
Figure 115 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
QD (POST-SB24337)	TLA IN CUT-OFF INCONSISTENCY	2

EFFECTS ON SYSTEM : Ⓢ NO EFFECT WHEN ENGINE IS RUNNING

CORRECTIVE ACTION



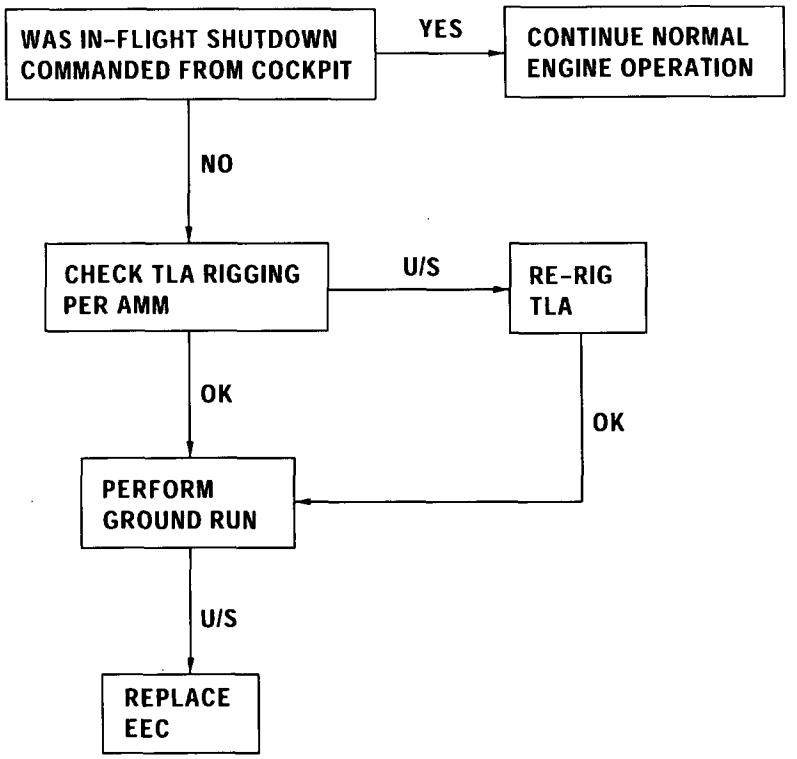
Post-SB24434/Pre-SB24514 C25661A

MFD Codes with LRU Prefix Q
Figure 115 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
QE (POST-SB24337)	COMMANDED SHUTDOWN IN AIR	0

EFFECTS ON SYSTEM : WILL RECORD MFD CODE BUT NOT AFFECT OPERATION

CORRECTIVE ACTION



Post-SB24434/Pre-SB24514 C25662

MFD Codes with LRU Prefix Q
Figure 115 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
QF	UNCOMMANDED SHUTDOWN IN AIR OR ON GROUND	0

EFFECTS ON SYSTEM : WILL RECORD MFD CODE BUT NOT AFFECT OPERATION

CORRECTIVE ACTION

DOWNLOAD EDS DATA AND RETURN TO PWC CUSTOMER SUPPORT
IF QF FAULT CODE OCCURS IN CONJUNCTION WITH OTHER FAULT CODES, FOLLOW THE CORRECTIVE ACTION FOR THE OTHER FAULT CODES.

Post-SB24434/Pre-SB24514 C61774A

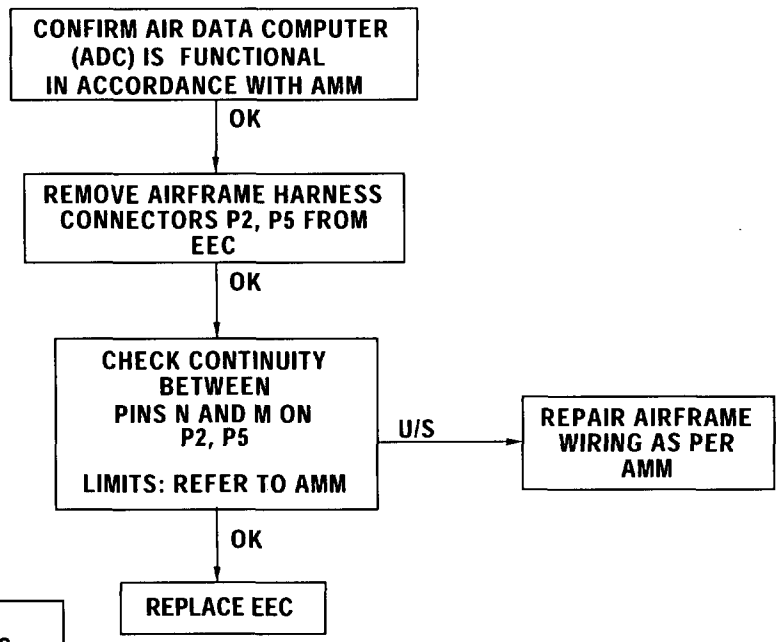
MFD Codes with LRU Prefix Q
Figure 115 (Sheet 5)

MFD CODE	FAULT	FAULT LEVEL
RA	ARINC RECEIVE	1

EFFECTS ON SYSTEM -Ⓓ FAULT WILL NOT DEGRADE OPERABILITY OF EEC CHANNEL BECAUSE LOSS OF ADC Pt AND Pamb WILL SELECT ENGINE SUPPLIED Pt AND Pamb.

-Ⓓ LOSS OF ADC TTO WILL ONLY DELETE THE AVAILABILITY OF ENGINE TTO BACKUP.

CORRECTIVE ACTION


CONFIRM AIR DATA COMPUTER (ADC) IS FUNCTIONAL IN ACCORDANCE WITH AMM
OK
REMOVE AIRFRAME HARNESS CONNECTORS P2, P5 FROM EEC
OK
CHECK CONTINUITY BETWEEN PINS N AND M ON P2, P5
LIMITS: REFER TO AMM
U/S
REPAIR AIRFRAME WIRING AS PER AMM
OK
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓓ = DUAL CHANNEL FAULT

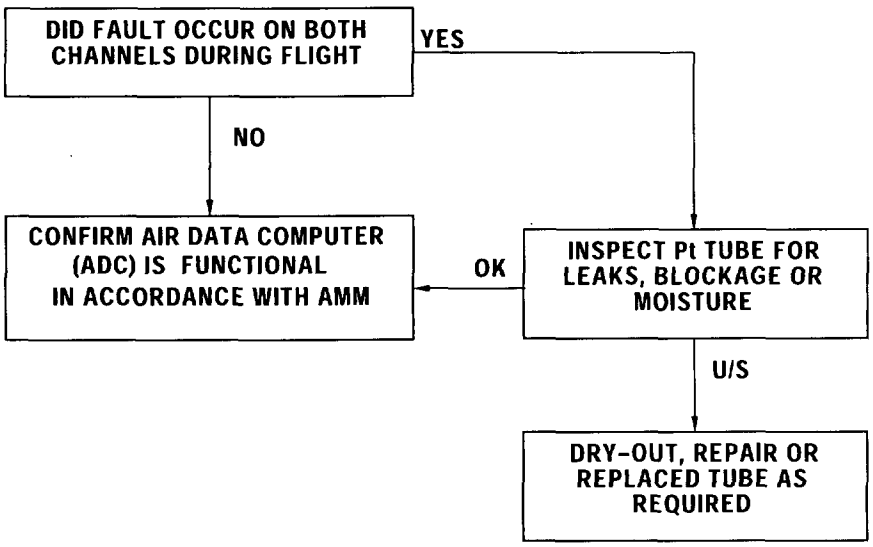
Post-SB24434/Pre-SB24514 C63477

MFD Codes with LRU Prefix R
Figure 116 (Sheet 1 of 3)

MFD CODE	FAULT	FAULT LEVEL	
RB	ADC Pt, RANGE FAIL OR IN RANGE COPARISON FAIL	PW305B 0	PW305A 1

EFFECTS ON SYSTEM -(D) FAULT WILL NOT DEGRADE OPERABILITY OF EEC CHANNEL BECAUSE LOSS OF ADC Pt WILL SELECT ENGINE SUPPLIED Pt.
-(D) LOSS OF N1 BUG INDICATION IF MFD CODES RB AND HB OCCUR TOGETHER
-(D) LANE CHANGE OCCURS (PRE SB-24434 / POST-SB24514)

CORRECTIVE ACTION


DID FAULT OCCUR ON BOTH CHANNELS DURING FLIGHT
YES
NO
CONFIRM AIR DATA COMPUTER (ADC) IS FUNCTIONAL IN ACCORDANCE WITH AMM
OK
INSPECT Pt TUBE FOR LEAKS, BLOCKAGE OR MOISTURE
U/S
DRY-OUT, REPAIR OR REPLACED TUBE AS REQUIRED

NOTE: (D) = DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C24686B

MFD Codes with LRU Prefix R
Figure 116 (Sheet 2)

NOTE:

Ⓢ= SINGLE CHANNEL FAULT
Ⓓ= DUAL CHANNEL FAULT

MFD CODE	FAULT	FAULT LEVEL	
		PW305B	PW305A
RC	ADC Pamb, RANGE FAIL OR IN RANGE COMPARISON FAIL	0	1
RD	ADC TTO, RANGE FAIL OR IN RANGE COMPARISON FAIL	0	1

EFFECTS ON SYSTEM : RC - Ⓓ FAULT WILL NOT DEGRADE OPERABILITY OF EEC CHANNEL.
- Ⓢ LOSS OF N1 BUG INDICATION IF MFD CODES RC AND JB OCCUR TOGETHER
- Ⓢ LOSS OF ADC Pamb WILL SELECT ENGINE SUPPLIED Pamb.

RD - Ⓓ FAULT MAY DEGRADE OPERABILITY OF EEC CHANNEL..
- Ⓢ LOSS OF N1 BUG INDICATION IF MFD CODES RD AND KB OCCUR TOGETHER
- Ⓢ LOSS OF ADC Pamb WILL SELECT ENGINE SUPPLIED Pamb.
- Ⓢ LOSS OF ADC TTO WILL SELECT THE DEFAULT TTO, IF THE ENGINE TTO HAS FAILED PRIOR TO ADC TTO.

CORRECTIVE ACTION:

CONFIRM AIR DATA COMPUTER (ADC) IS FUNCTIONAL IN ACCORDANCE WITH AMM

Post-SB24434/Pre-SB24514 C113381

MFD Codes with LRU Prefix R
Figure 116 (Sheet 3)

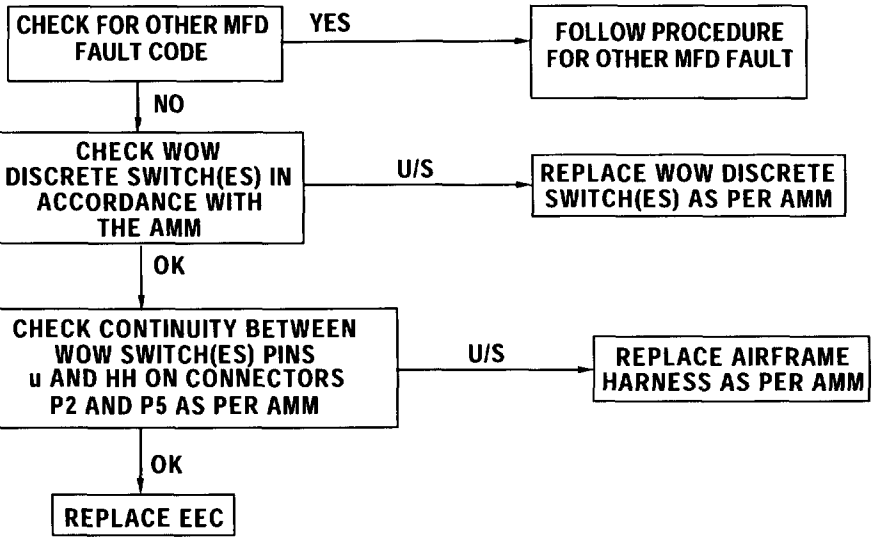
P&WC Proprietary Information. Subject to the restrictions on the title page.

MFD CODE	FAULT	FAULT LEVEL
SA	WOW DISCRETE CHECK	2

EFFECTS ON SYSTEM - FAULT INDICATES AIR DATA COMPUTER AIRSPEED IS:
- LESS THAN 50 KNOTS WITH A/C IN FLIGHT (WOWF = 0)
OR
- GREATER THAN 330 KNOTS WITH A/C ON THE GROUND (WOWF = 1)

-(D) IMPROPER FLIGHT LEG FAULT RECORDING
-(D) NO THRUST REVERSER OPERATION
-(D) NO ABORT START CAPABILITY
-(D) ENGINE RUNNING TO FLIGHT IDLE SPEED WHEN AIRCRAFT IS ON GROUND
-(D) LONG START TIMES
-(S) EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION


CHECK FOR OTHER MFD FAULT CODE
YES
FOLLOW PROCEDURE FOR OTHER MFD FAULT
NO
CHECK WOW DISCRETE SWITCH(ES) IN ACCORDANCE WITH THE AMM
U/S
REPLACE WOW DISCRETE SWITCH(ES) AS PER AMM
OK
CHECK CONTINUITY BETWEEN WOW SWITCH(ES) PINS u AND HH ON CONNECTORS P2 AND P5 AS PER AMM
U/S
REPLACE AIRFRAME HARNESS AS PER AMM
OK
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: (S) = SINGLE CHANNEL FAULT
(D) = DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C32934D

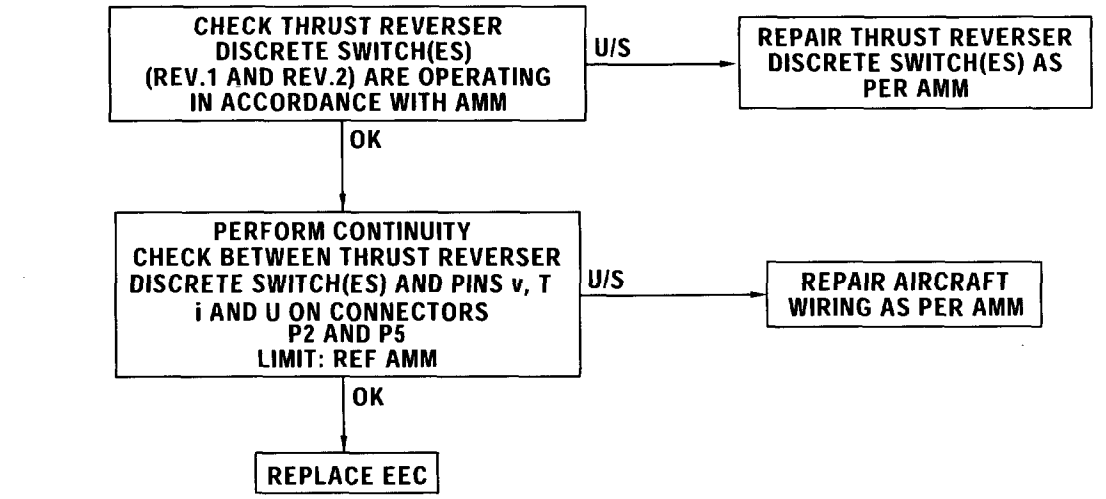
MFD Codes with LRU Prefix S
Figure 117

MFD CODE	FAULT	FAULT LEVEL
TA	THRUST REVERSER DISCRETES SEQUENCE CHECK	3
TB	THRUST REVERSER SPURIOUS DISCRETE	2

EFFECTS ON SYSTEM : TA - Ⓓ ENGINE SPEED DROPS TO IDLE
- Ⓢ EEC CHANNEL SWITCHOVER

TB - Ⓓ INHIBITS THRUST REVERSER THROTTLE LEVER SCHEDULE
- Ⓢ EEC CHANNEL SWITCHOVER
- Ⓓ NO SYSTEM DEGRADATION. FORWARD THRUST SCHEDULE MAINTAINED
- Ⓢ FAULT RESETTABLE BY STOWING THRUST REVERSER

CORRECTIVE ACTION


CHECK THRUST REVERSER DISCRETE SWITCH(ES) (REV.1 AND REV.2) ARE OPERATING IN ACCORDANCE WITH AMM
U/S
REPAIR THRUST REVERSER DISCRETE SWITCH(ES) AS PER AMM
OK
PERFORM CONTINUITY CHECK BETWEEN THRUST REVERSER DISCRETE SWITCH(ES) AND PINS v, T i AND U ON CONNECTORS P2 AND P5 LIMIT: REF AMM
U/S
REPAIR AIRCRAFT WIRING AS PER AMM
OK
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓢ = SINGLE CHANNEL FAULT
Ⓓ = DUAL CHANNEL FAULT

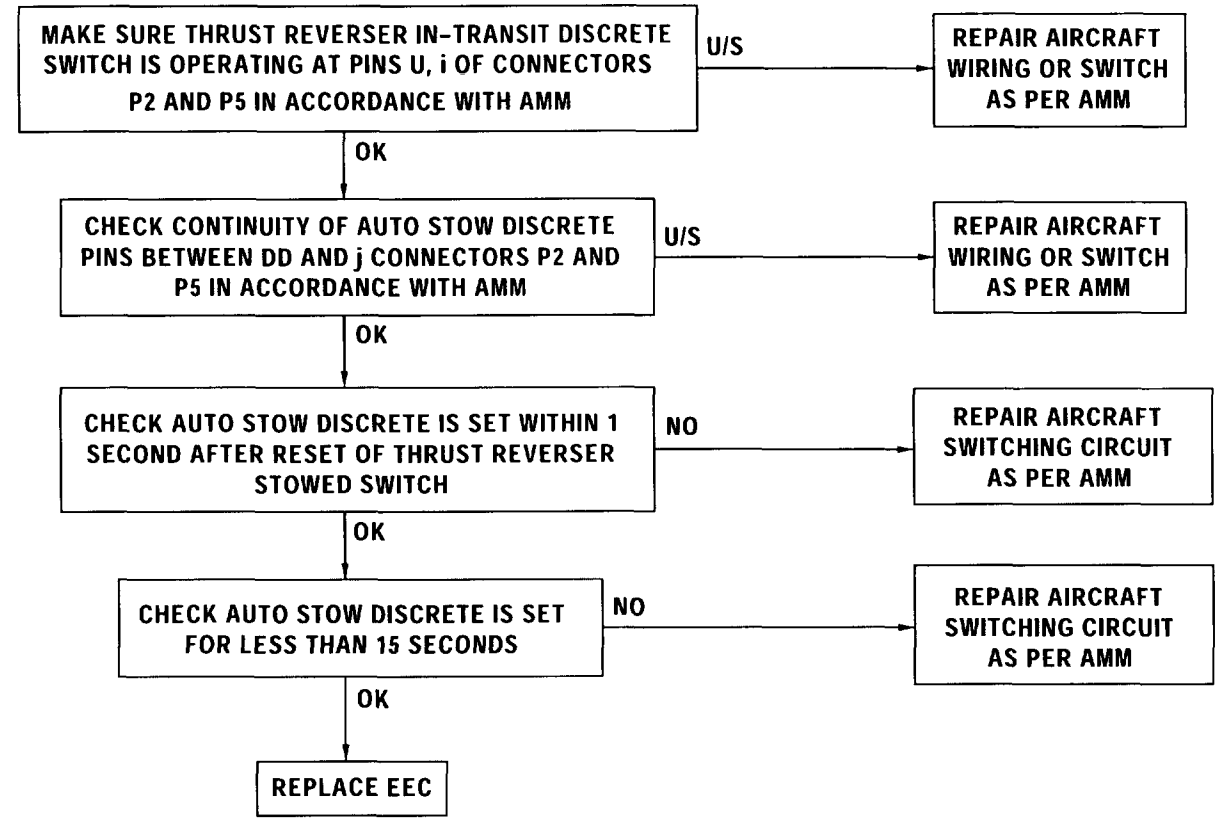
Post-SB24434/Pre-SB24514 C63537

MFD Codes with LRU Prefix T
Figure 118 (Sheet 1 of 3)

MFD CODE	FAULT	FAULT LEVEL
TC	AUTO STOW DISCRETE INPUT FAULT	1

EFFECTS ON SYSTEM - CAN NOT CLEAR T/R SEQUENCE FAULT

CORRECTIVE ACTION


MAKE SURE THRUST REVERSER IN-TRANSIT DISCRETE SWITCH IS OPERATING AT PINS U, i OF CONNECTORS P2 AND P5 IN ACCORDANCE WITH AMM
U/S
REPAIR AIRCRAFT WIRING OR SWITCH AS PER AMM
OK
CHECK CONTINUITY OF AUTO STOW DISCRETE PINS BETWEEN DD AND j CONNECTORS P2 AND P5 IN ACCORDANCE WITH AMM
U/S
REPAIR AIRCRAFT WIRING OR SWITCH AS PER AMM
OK
CHECK AUTO STOW DISCRETE IS SET WITHIN 1 SECOND AFTER RESET OF THRUST REVERSER STOWED SWITCH
NO
REPAIR AIRCRAFT SWITCHING CIRCUIT AS PER AMM
OK
CHECK AUTO STOW DISCRETE IS SET FOR LESS THAN 15 SECONDS
NO
REPAIR AIRCRAFT SWITCHING CIRCUIT AS PER AMM
OK
REPLACE EEC

FOR CHANNEL	CHECK CONNECTOR(S)
A	P2
B	P5

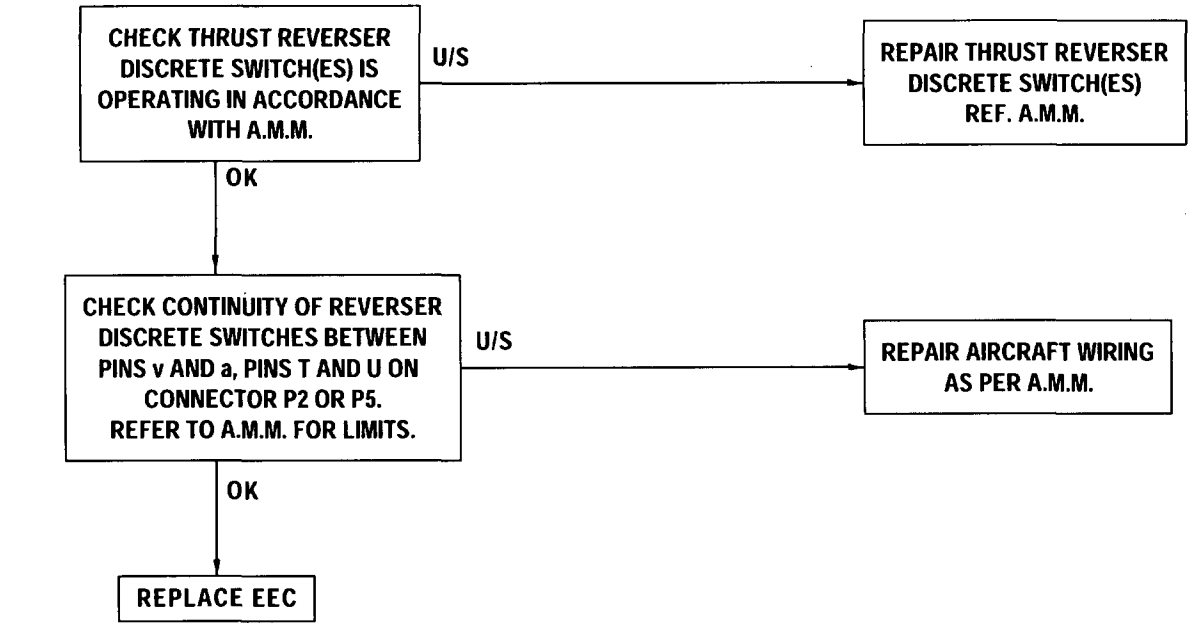
Post-SB24434/Pre-SB24514 C63538

MFD Codes with LRU Prefix T
Figure 118 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
TD	THRUST REVERSER DISCRETE FAULT	3
TE	T/R IN TRANSIT FAULT ON POWER-UP	

EFFECTS ON SYSTEM: TD -(D) ENGINE SPEED SET TO IDLE REGARDLESS OF TLA POSITION.
-(S) LANE CHANGE
TE -(D) ENGINE SPEED LIMITED AT IDLE WHEN IN TRANSIT DISCRETE SET.
-(S) LANE CHANGE

CORRECTIVE ACTION


CHECK THRUST REVERSER DISCRETE SWITCH(ES) IS OPERATING IN ACCORDANCE WITH A.M.M.
U/S
REPAIR THRUST REVERSER DISCRETE SWITCH(ES) REF. A.M.M.
OK
CHECK CONTINUITY OF REVERSER DISCRETE SWITCHES BETWEEN PINS v AND a, PINS T AND U ON CONNECTOR P2 OR P5. REFER TO A.M.M. FOR LIMITS.
U/S
REPAIR AIRCRAFT WIRING AS PER A.M.M.
OK
REPLACE EEC

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: (S) = SINGLE CHANNEL FAULT
(D) = DUAL CHANNEL FAULT

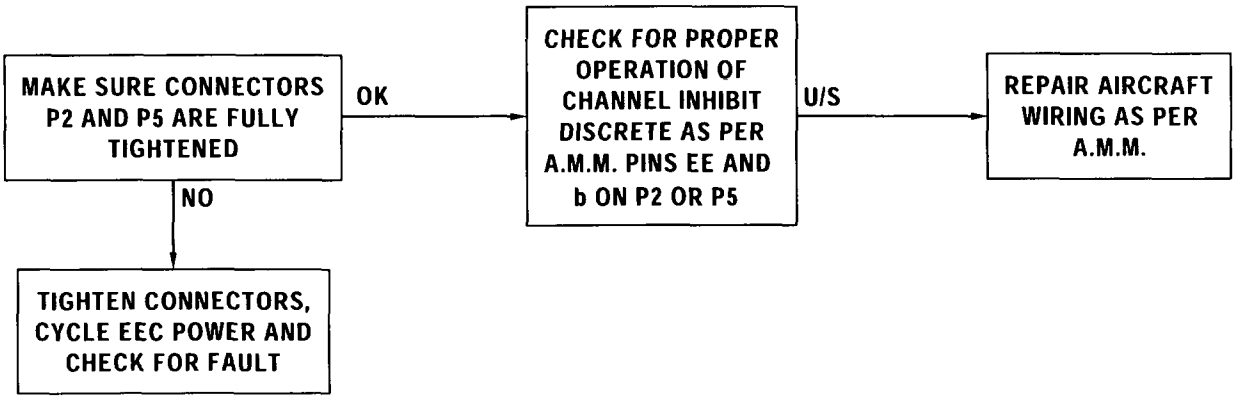
Post-SB24434/Pre-SB24514 C63539

MFD Codes with LRU Prefix T
Figure 118 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
VB (PW305A ONLY)	CHANNEL INHIBIT DISCRETE INPUT FAULT	1

EFFECTS ON SYSTEM: - CHANNEL INHIBIT DISCRETE IS DISABLED

CORRECTIVE ACTION


MAKE SURE CONNECTORS P2 AND P5 ARE FULLY TIGHTENED
OK
CHECK FOR PROPER OPERATION OF CHANNEL INHIBIT DISCRETE AS PER A.M.M. PINS EE AND b ON P2 OR P5
U/S
REPAIR AIRCRAFT WIRING AS PER A.M.M.
NO
TIGHTEN CONNECTORS, CYCLE EEC POWER AND CHECK FOR FAULT

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

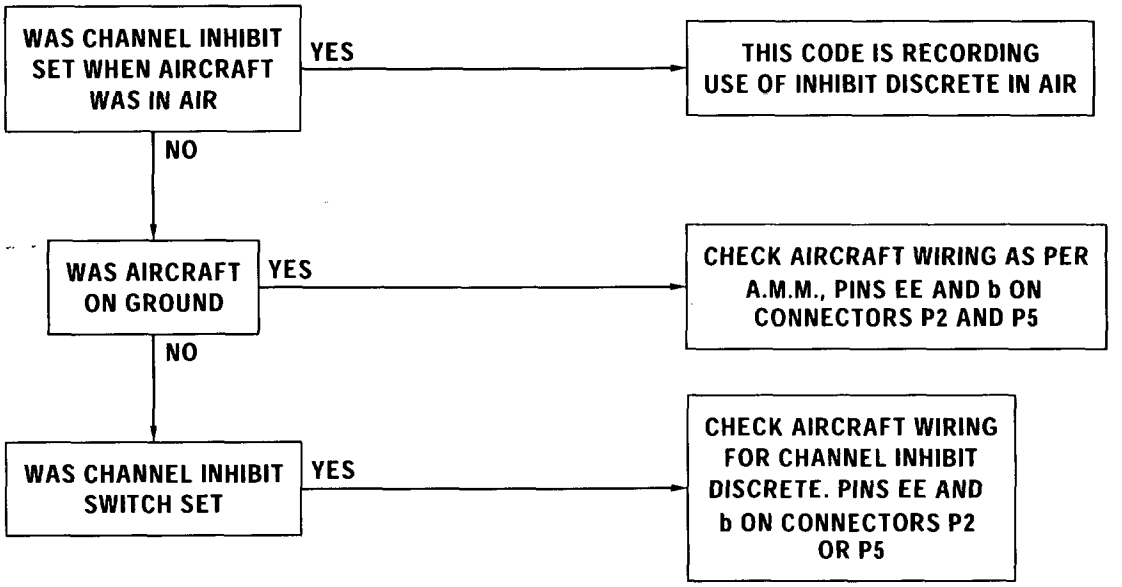
Post-SB24434/Pre-SB24514 C63577

MFD Codes with LRU Prefix V
Figure 119 (Sheet 1 of 5)

MFD CODE	FAULT	FAULT LEVEL
VC (PW305A ONLY)	CHANNEL INHIBITED IN AIR	0

EFFECTS ON SYSTEM: - WILL RECORD MFD CODE BUT NOT AFFECT OPERATION

CORRECTIVE ACTION


WAS CHANNEL INHIBIT SET WHEN AIRCRAFT WAS IN AIR
YES
THIS CODE IS RECORDING USE OF INHIBIT DISCRETE IN AIR
NO
WAS AIRCRAFT ON GROUND
YES
CHECK AIRCRAFT WIRING AS PER A.M.M., PINS EE AND b ON CONNECTORS P2 AND P5
NO
WAS CHANNEL INHIBIT SWITCH SET
YES
CHECK AIRCRAFT WIRING FOR CHANNEL INHIBIT DISCRETE. PINS EE AND b ON CONNECTORS P2 OR P5

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

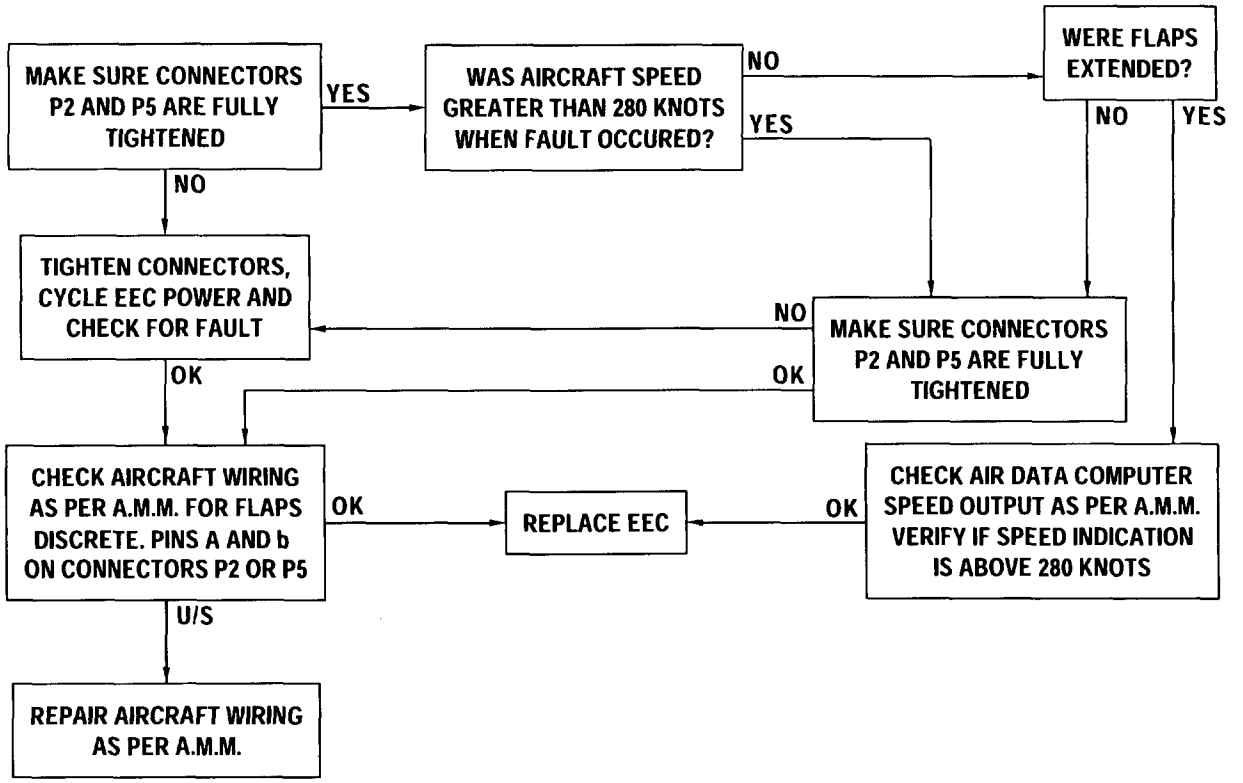
Post-SB24434/Pre-SB24514 C63579

MFD Codes with LRU Prefix V
Figure 119 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
VD (PW305A ONLY)	FLAP DISCRETE INPUT FAULT	1

EFFECTS ON SYSTEM : - Ⓓ N1 BUG INDICATION - INSTEAD OF INDICATING THE TAKEOFF RATING DURING APPROACH, N1 BUG WILL INDICATE THE NEXT HIGHER DETENTE RATING

CORRECTIVE ACTION


MAKE SURE CONNECTORS P2 AND P5 ARE FULLY TIGHTENED
YES
WAS AIRCRAFT SPEED GREATER THAN 280 KNOTS WHEN FAULT OCCURED?
NO
WERE FLAPS EXTENDED?
YES
NO
YES
NO
TIGHTEN CONNECTORS, CYCLE EEC POWER AND CHECK FOR FAULT
NO
MAKE SURE CONNECTORS P2 AND P5 ARE FULLY TIGHTENED
OK
OK
CHECK AIRCRAFT WIRING AS PER A.M.M. FOR FLAPS DISCRETE. PINS A AND b ON CONNECTORS P2 OR P5
OK
REPLACE EEC
OK
CHECK AIR DATA COMPUTER SPEED OUTPUT AS PER A.M.M. VERIFY IF SPEED INDICATION IS ABOVE 280 KNOTS
U/S
REPAIR AIRCRAFT WIRING AS PER A.M.M.

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

NOTE: Ⓓ = DUAL CHANNEL FAULT

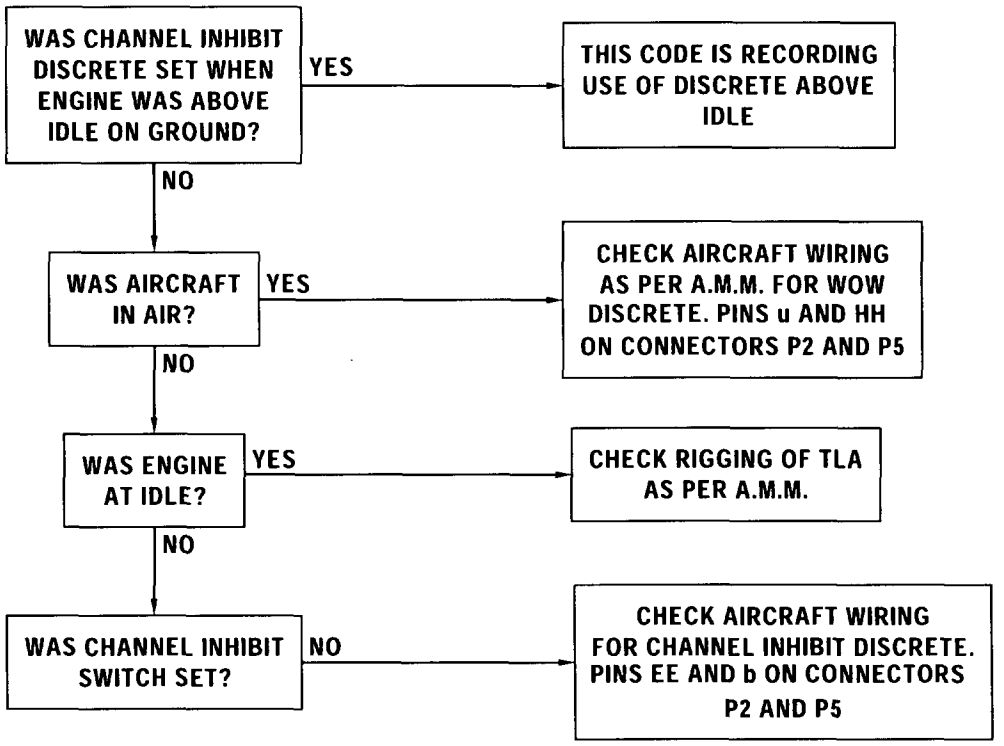
Post-SB24434/Pre-SB24514 C63594

MFD Codes with LRU Prefix V
Figure 119 (Sheet 3)

MFD CODE	FAULT	FAULT LEVEL
VE (PW305A ONLY)	USE OF CHANNEL INHIBIT ON GROUND	2

EFFECTS ON SYSTEM: - EEC CHANNEL SWITCHOVER

CORRECTIVE ACTION


WAS CHANNEL INHIBIT DISCRETE SET WHEN ENGINE WAS ABOVE IDLE ON GROUND?
YES
THIS CODE IS RECORDING USE OF DISCRETE ABOVE IDLE
NO
WAS AIRCRAFT IN AIR?
YES
CHECK AIRCRAFT WIRING AS PER A.M.M. FOR WOW DISCRETE. PINS u AND HH ON CONNECTORS P2 AND P5
NO
WAS ENGINE AT IDLE?
YES
CHECK RIGGING OF TLA AS PER A.M.M.
NO
WAS CHANNEL INHIBIT SWITCH SET?
NO
CHECK AIRCRAFT WIRING FOR CHANNEL INHIBIT DISCRETE. PINS EE AND b ON CONNECTORS P2 AND P5

FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

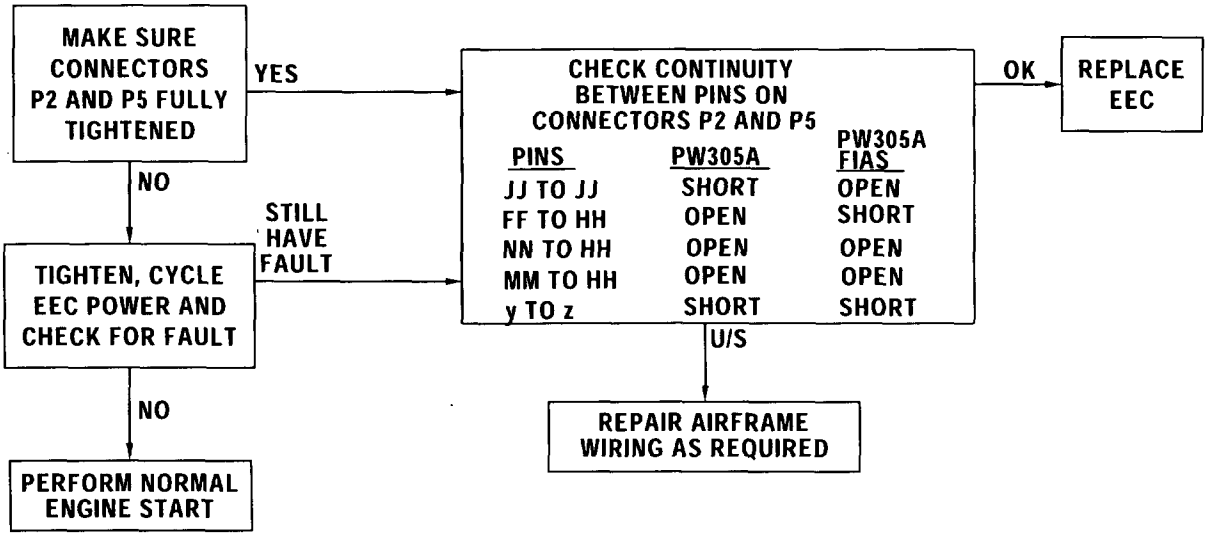
Post-SB24434/Pre-SB24514 C63602

MFD Codes with LRU Prefix V
Figure 119 (Sheet 4)

MFD CODE	FAULT	FAULT LEVEL
VF	AIRCRAFT IDENTIFICATION FAULT	3

EFFECTS ON SYSTEM - SOFTWARE AND AIRCRAFT INCOMPATIBLE

CORRECTIVE ACTION



FOR CHANNEL	CHECK CONNECTORS
A	P2
B	P5

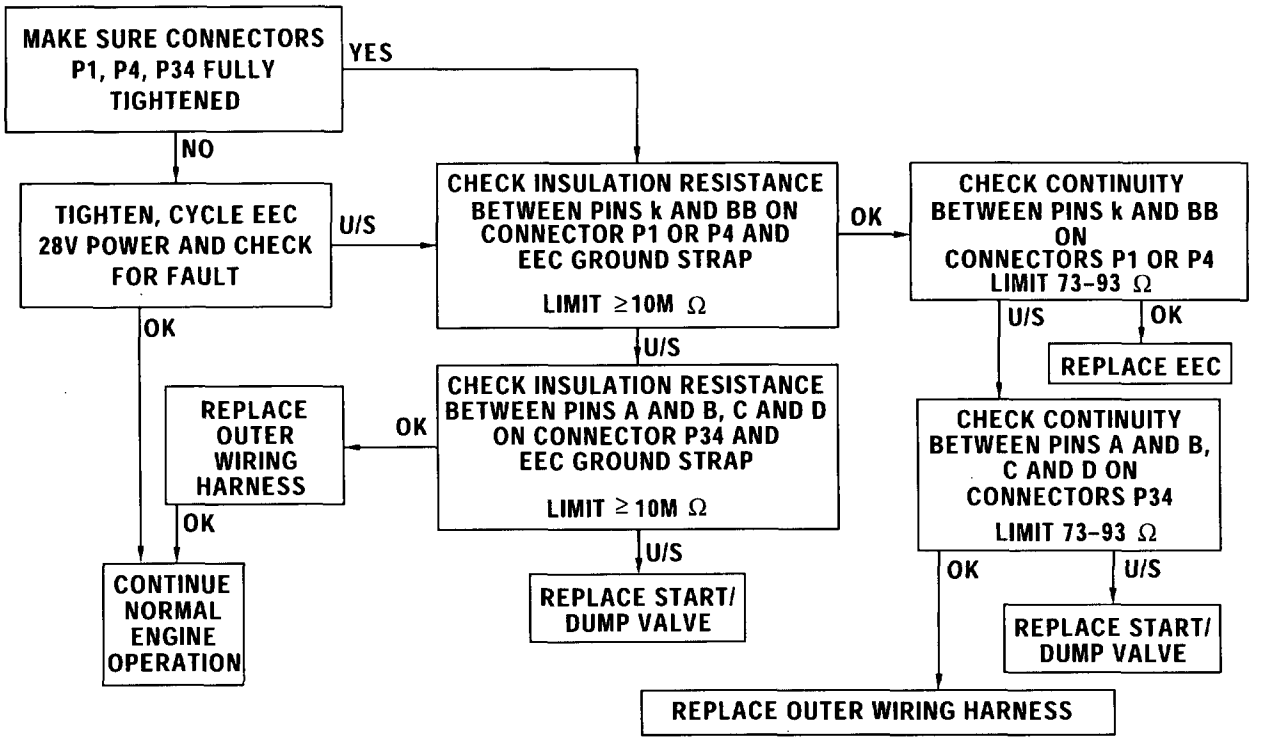
Post-SB24434/Pre-SB24514 C63818

MFD Codes with LRU Prefix V
Figure 119 (Sheet 5)

MFD CODE	FAULT	FAULT LEVEL
WB	START VALVE DRIVE INTERNAL OPEN CIRCUIT	1
WC	START VALVE DRIVE INTERNAL OR EXTERNAL SHORT CIRCUIT OR EXTERNAL OPEN CIRCUIT	1

EFFECTS ON SYSTEM - (D) GROUND STARTS LONGER AND COOLER THAN NORMAL.
NO IMPACT ON AIR STARTS.
- (S) CHANNEL SWITCHOVER.

CORRECTIVE ACTION


MAKE SURE CONNECTORS P1, P4, P34 FULLY TIGHTENED
YES
NO
TIGHTEN, CYCLE EEC 28V POWER AND CHECK FOR FAULT
U/S
OK
CHECK INSULATION RESISTANCE BETWEEN PINS k AND BB ON CONNECTOR P1 OR P4 AND EEC GROUND STRAP
LIMIT ≥10M Ω
OK
U/S
CHECK CONTINUITY BETWEEN PINS k AND BB ON CONNECTORS P1 OR P4
LIMIT 73-93 Ω
U/S
OK
REPLACE EEC
CHECK INSULATION RESISTANCE BETWEEN PINS A AND B, C AND D ON CONNECTOR P34 AND EEC GROUND STRAP
LIMIT ≥ 10M Ω
OK
REPLACE OUTER WIRING HARNESS
OK
U/S
CHECK CONTINUITY BETWEEN PINS A AND B, C AND D ON CONNECTORS P34
LIMIT 73-93 Ω
OK
U/S
REPLACE START/ DUMP VALVE
CONTINUE NORMAL ENGINE OPERATION
REPLACE START/ DUMP VALVE
REPLACE OUTER WIRING HARNESS

FOR CHANNEL	CHECK CONNECTORS
A	P1, P34
B	P4, P34

NOTE: (S) = SINGLE CHANNEL FAULT
(D) = DUAL CHANNEL FAULT

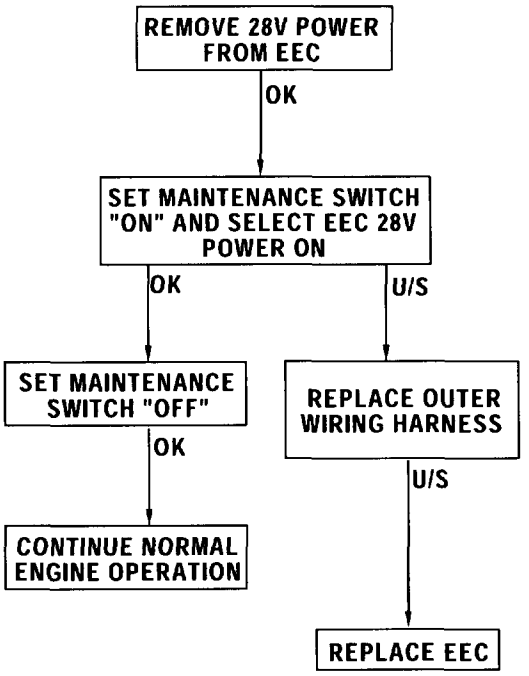
Post-SB24434/Pre-SB24514 C61771B

MFD Codes with LRU Prefix W
Figure 120 (Sheet 1 of 3)

MFD CODE	FAULT	FAULT LEVEL
WD	START VALVE NOT FITTED BUT DETECTED	1

EFFECTS ON SYSTEM - (D) GROUND STARTS LONGER AND COOLER THAN NORMAL.
NO IMPACT ON AIR STARTS.
- (S) CHANNEL SWITCHOVER.

CORRECTIVE ACTION



NOTE: (S) = SINGLE CHANNEL FAULT
(D) = DUAL CHANNEL FAULT

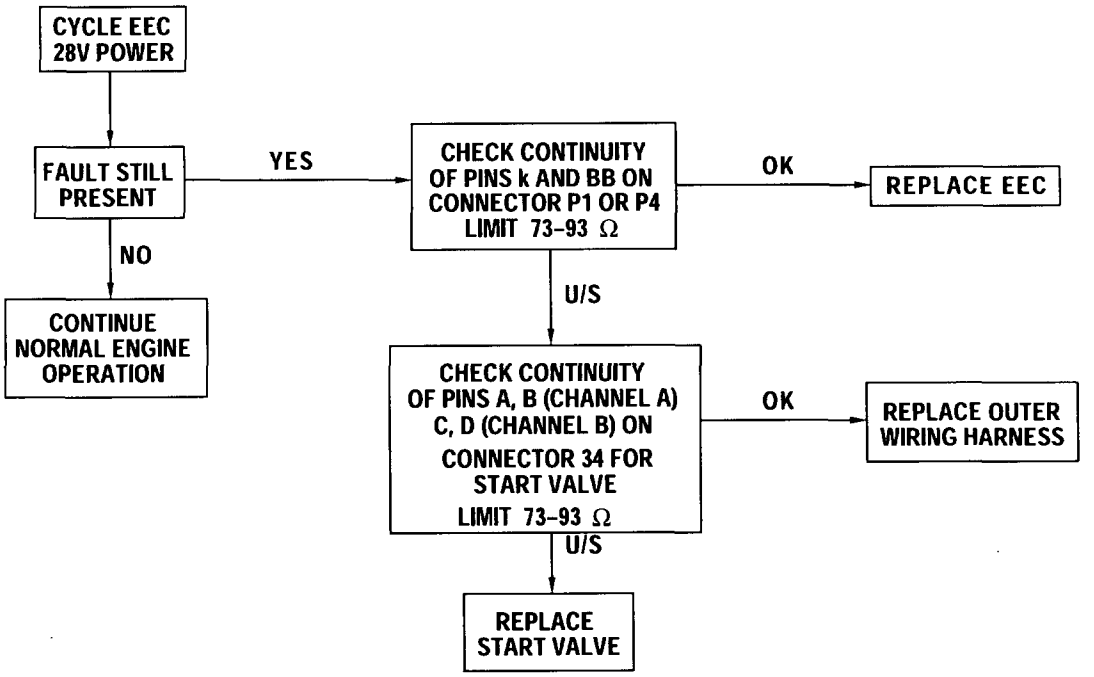
Post-SB24434/Pre-SB24514 C32947B

MFD Codes with LRU Prefix W
Figure 120 (Sheet 2)

MFD CODE	FAULT	FAULT LEVEL
WE	START VALVE DRIVER FAULT	2

EFFECTS ON SYSTEM -Ⓢ EEC CHANNEL SWITCHOVER
-Ⓓ LOSS OF START VALVE CONTROL

CORRECTIVE ACTION


CYCLE EEC 28V POWER
FAULT STILL PRESENT
YES
NO
CONTINUE NORMAL ENGINE OPERATION
CHECK CONTINUITY OF PINS k AND BB ON CONNECTOR P1 OR P4 LIMIT 73-93 Ω
OK
REPLACE EEC
U/S
CHECK CONTINUITY OF PINS A, B (CHANNEL A) C, D (CHANNEL B) ON CONNECTOR 34 FOR START VALVE LIMIT 73-93 Ω
OK
REPLACE OUTER WIRING HARNESS
U/S
REPLACE START VALVE

FOR CHANNEL	CHECK CONNECTORS
A	P1
B	P4

NOTE: Ⓢ = SINGLE CHANNEL FAULT
Ⓓ = DUAL CHANNEL FAULT

Post-SB24434/Pre-SB24514 C64020

MFD Codes with LRU Prefix W
Figure 120 (Sheet 3)

ENGINE - SERVICING

1. General

A. This section contains the servicing procedures applicable to the engine. The procedures are sub-divided to cover four main topics: Oil System Servicing, Preparation for Service or Storage, Preservation/Depreservation and Removal/Installation from/in Maintenance Stand.

B. Oil system servicing involves oil level checks, replenishing, draining, flushing and refilling.

C. Preparation of the engine for service or storage involves removal or installation of the engine from its shipping container. Preservation/depreservation covers protection of the engine and the engine oil and fuel systems.

2. Consumable Materials

The consumable materials listed below are identified in procedural text.

Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-063	Steel, Strapping
PWC05-069	Tape, Pressure Sensitive Adhesive
PWC05-070	Tape, Pressure Sensitive Adhesive
PWC05-077	Oil, Preservative
PWC05-089	Lockwire
PWC06-004	Compound, Antiseize
PWC11-027	Solvent

3. Special Tools

The special tools listed below are used in the following procedures.

Tool No.	Name	Application
PWC37728	Puller	
PWC40453	Stand, Build	Alternate to PWC66300
PWC43172	Puller	
PWC60364	Bracket	
PWC60838	Bracket	
PWC60839	Bracket	
PWC61373	Sling	
PWC66103	Puller	
PWC66106	Sling	
PWC66300	Stand	Obsolete - replaced by PWC40453

4. Fixtures, Equipment and Supplier Tools

Not Applicable

5. Oil System Servicing

CAUTION: DURING ALL OIL SYSTEM SERVICING, MAKE SURE EQUIPMENT AND CONTAINERS USED ARE ABSOLUTELY CLEAN. TAKE CARE TO PREVENT INGRESS OF ANY MATTER WHICH COULD CAUSE CONTAMINATION.

NOTE: P&WC does not recommend the casual mixing of different brands or types of oil. If oil mixing is necessary, refer to Chapter 72-00-00, Description and Operation and Chapter 05-20-00, SCHEDULED MAINTENANCE CHECKS.

A. General

For lubricating oil specifications, refer to Chapter 72-00-00, Description and Operation.

Recommendations for oil change intervals are based on the performance of specific brands and types of oil, specific engine models and operating criteria. General oil change intervals may be extended periodically and will be reflected by revisions to Chapter 05-20-00, SCHEDULED MAINTENANCE CHECKS.

Permission for extension of oil drain intervals may be granted to operators through monitoring programs conducted by most major oil companies which have been approved by Pratt & Whitney Canada. Chapter 72-00-00, Description and Operation will be revised accordingly to include newly approved oils.

In cases where oils approved by P&WC are not available and other oils have to be substituted, an operator must obtain prior approval or recommendations for use of such oil from:

Pratt & Whitney Canada
1000 Marie-Victorin Blvd.
Longueuil, Quebec
Canada J4G 1A1

Attention: Customer Support

B. Replacement of Oil with a Different Approved Brand

(1) If replacing an oil listed in Table 12 (Ref. Chapter 72-00-00, Description and Operation, Table 12, Approved Lubricating Oils - PWA521, Type II (5 Centistokes)) with another oil also listed in Table 12, continue as follows:

(a) Add new oil as required (top off).

NOTE: Original oil does not need to be drained and engine does not need to be flushed.

(2) If replacing an oil listed in Table 12, with an oil listed in Table 13 (Ref. Chapter 72-00-00, Description and Operation, Table 13, Approved Lubricating Oils - PWA521, Type II (5 Centistokes) "THIRD GENERATION"), or replacing an oil listed in Table 13, with an oil listed in Table 12, continue as follows:

(a) Replace oil filter and add new oil as required (top off).

NOTE: Original oil does not need to be drained and engine does not need to be flushed.

(b) Do a visual check of the oil filter for carbon deposits at the following intervals:

- At the next aircraft line check or 60 Flight Hours (FH) max.
- At 200 FH max. after the replacement with the new brand.
- At 400 FH max. after the replacement with the new brand.

(c) If large quantities of carbon deposits are found (i.e. loose carbon deposits cover most of the oil filter surface and the inside cavity of the filter), stop the replacement process and continue as follows:

1 Replace the oil filter, drain and flush the oil system.

2 Fill with the original brand of oil and continue oil filter inspection at the above intervals.

3 If carbon deposits are still found in large quantities, contact P&WC for further action.

(d) If the oil filter condition is normal, return to the standard oil filter maintenance interval.

(3) If oils of different brands or viscosities are accidentally combined, continue as follows:

(a) If the combined oils are listed in Table 12 (not "Third Generation"), no further action is required.

(b) For any other combination of approved oils listed in Table 12 or Table 13, continue as follows:

1 Do a visual check of the oil filter.

2 Do another visual check of the oil filter at the next line check or max. 60 FH.

3 If large quantities of carbon deposits are found (i.e. loose carbon deposits cover most of the oil filter surface and the inside cavity of the filter), continue as follows:

a Replace the oil filter element.

b Drain, flush and refill the oil system with the original oil.

c Do a visual check of the oil filter at the next line check or max 60 FH.

d Contact P&WC if large quantities of carbon deposits are still found.

4 Alternatively, return to the standard oil filter maintenance interval.

(4) It is recommended that operators wishing to monitor oil quality, should establish a program in collaboration with their oil supplier/manufacturer.

C. Blue Oil Dye

(1) This dye (PWC05-372) may be added to any P&WC approved lubricating oil on a one time basis when filling the system. The dye improves sight glass visibility and aids in the detection of oil leaks.

(2) Use 0.122 - 0.171 milliliters per liter, or 0.462 - 0.647 milliliters per U.S. gallon of oil. The maximum concentration must not exceed 0.171 milliliters per liter, or 0.647 milliliters per U.S. gallon.

(3) The dye is blue in color, however, when mixed with some oils which are yellow in color, the result may be green colored oil.

TABLE 301, Approved Dye

BRAND	SUPPLIER
Octel Oil Blue B Liquid Dye	Octel Starreon LLC 8375 South Willow Street 5th Floor Littleton, Colorado USA 80124 TEL: (303) 792-5554 FAX: (303) 792-5280 web: http://www.octel-starreon.com

D. Oil Analysis

(1) Before obtaining an oil sample to analyze, start the engine and run until oil temperature is 70°C (158°F) minimum. Shutdown the engine.

(2) If the Total Acid Number (TAN) is above 1.0, or water content is more than 800 parts per million, either by weight or by volume, continue as follows:

(a) Drain and discard oil from the oil tank (Ref. Para. G.).

P&WC Proprietary Information. Subject to the restrictions on the title page.

(b) Refill the oil tank with fresh oil (Ref. Para. H.).

NOTE: 1. The value of TAN in unused oil conforming to specification varies, depending on brand and manufacturer.

NOTE: 2. As oil deteriorates, the color becomes black and a strong harsh odor is given off. This is not a reason to change the oil, but the oil should be analyzed.

NOTE: 3. Use a Titra-Lube TAN Test Kit (P/N TI-TAN) to analyze the oil. The kit can be obtained from the following address or contact a local distributor for availability of the kit:

Dexsil Chemical Corp.
1 Hamden Park Drive
Hamden, CT 06517
USA

TEL: 1-800-4-DEXSIL
203-288-3509
FAX: 203-248-6523

E. Warm Engine Oil Level Check (Ref. Fig. 301)

NOTE: P&WC does not recommend the casual mixing of different brands or types of oil. If oil mixing is necessary, refer to Chapter 72-00-00, Description and Operation and Chapter 05-20-00, SCHEDULED MAINTENANCE CHECKS.

NOTE: Warm Engine definition is an engine that has been shut down for less than 10 minutes, with cockpit instrumentation powered ITT display, indicating a temperature reading. This method of checking oil levels during the warm engine period reduces the possibility of over servicing and makes sure of an accurate reading of oil consumption.

(1) Pre-SB24021 and PW305A Filler Neck (Dipstick):

(a) Unlock and withdraw filler cap from filler neck located forward of Flange C.

(b) Check oil tank contents against marking on dipstick and service with approved oil as follows:

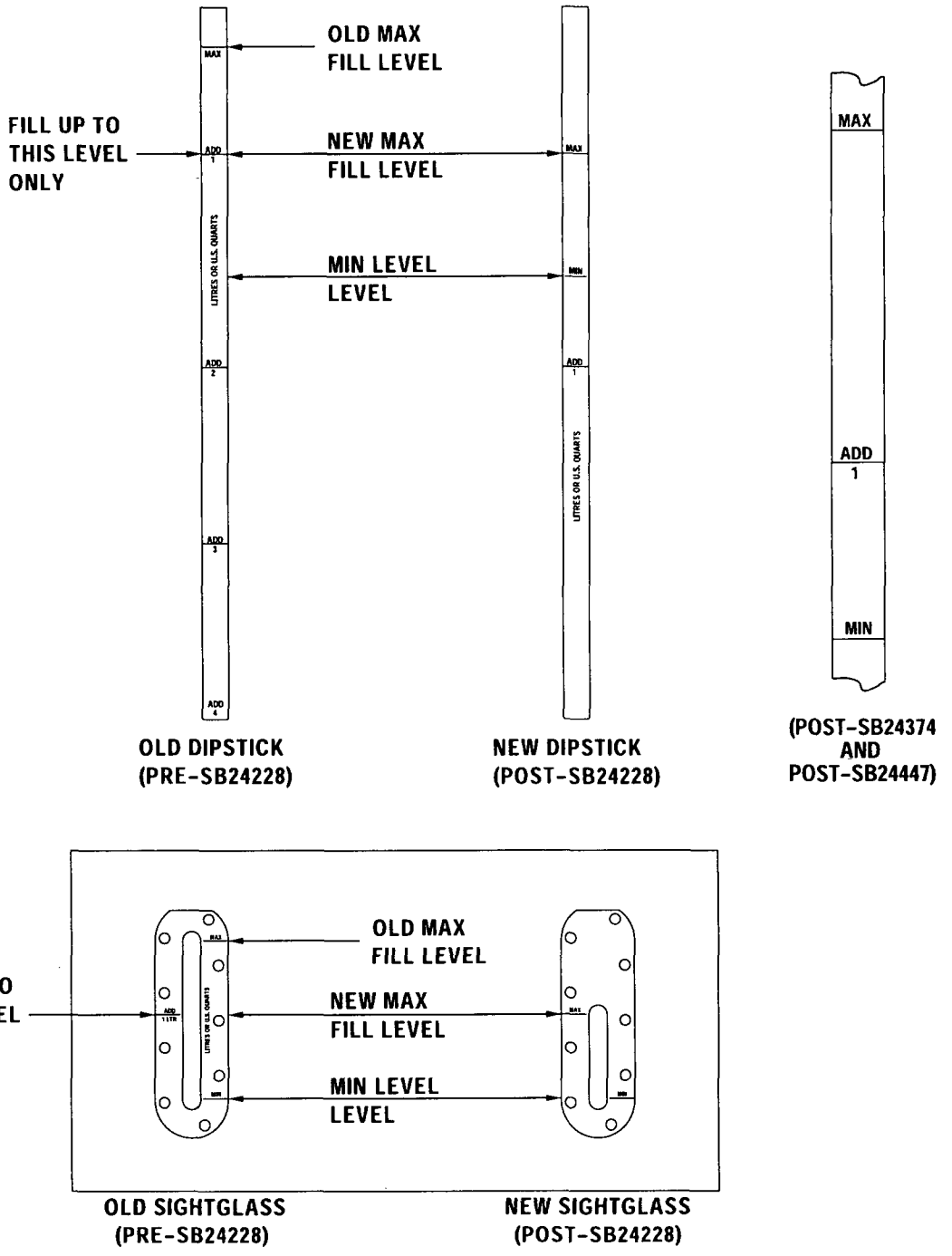
1 Pre-SB24228: Add oil up to the "ADD 1" level.

2 Post-SB24228: Add oil up to the "MAX" level.

CAUTION: MAKE SURE FILLER CAP IS LOCKED SECURELY. CAPS NOT INSTALLED CORRECTLY CAN CAUSE COMPLETE LOSS OF OIL.

(c) Install filler cap in filler neck. Make sure cap is correctly installed and locked securely. Wipe off any spilled oil.

(2) Post-SB24021 and PW305B Filler Neck (Sight Glass)



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Oil System Servicing
Figure 301

(a) Check oil tank contents against markings on dipstick and from sight glass oil level indicator.

(b) Unlock and withdraw filler cap from filler neck and service with approved oil as follows:

1 Pre-SB24228: Add oil up to "ADD 1 LTR" level.

2 Post-SB24228: Add oil up to "MAX" level.

CAUTION: MAKE SURE FILLER CAP IS LOCKED SECURELY. CAPS NOT INSTALLED CORRECTLY CAN CAUSE COMPLETE LOSS OF OIL.

(c) Install filler cap in filler neck. Make sure cap is correctly installed and locked securely. Wipe off any spilled oil.

(3) If oil tank contents are below minimum level of dipstick or sight glass, proceed as follows:

(a) Check for external leakage and repair as necessary.

(b) Service oil tank.

(c) Install filler cap in filler neck. Make sure cap is correctly installed and locked securely.

(d) Perform 15 minute engine run at idle (Ref. 71-00-00 ADJUSTMENT/TEST).

(e) Check oil level 10 minutes after engine is shut down. If satisfactory, no further action is required.

F. Cold Engine Oil Level Check (Ref. Fig. 301)

NOTE: 1. P&WC does not recommend the casual mixing of different brands or types of oil. If oil mixing is necessary, refer to Chapter 72-00-00, Description and Operation and Chapter 05-20-00, SCHEDULED MAINTENANCE CHECKS.

NOTE: 2. Whenever possible the engine oil level should be checked when the engine is warm.

NOTE: 3. Cold Engine definition is an engine that has been shut down for more than 10 minutes, with cockpit instrumentation powered ITT display, indicating no temperature reading. This method of checking oil levels during the cold engine period reduces the possibility of over servicing and makes sure of an accurate reading of oil consumption.

(1) Pre-SB24021 and PW305A Filler Neck (Dipstick):

(a) Unlock and withdraw filler cap from filler neck located forward of Flange C.

(b) Check oil tank contents against marking on dipstick and service with approved oil as follows:

1 Pre-SB24228: Add oil up to the "ADD 1" level.

2 Post-SB24228: Add oil up to the "MIN" level.

CAUTION: MAKE SURE FILLER CAP IS LOCKED SECURELY. CAPS NOT INSTALLED CORRECTLY CAN CAUSE COMPLETE LOSS OF OIL.

(c) Install filler cap in filler neck. Make sure cap is correctly installed and locked securely. Wipe off any spilled oil.

(2) Post-SB24021 and PW305B Filler Neck (Sight Glass)

(a) Check oil tank contents against markings on dipstick and from sight glass oil level indicator.

(b) Unlock and withdraw filler cap from filler neck and service with approved oil as follows:

1 Pre-SB24228: Add oil up to "ADD 1 LTR" level.

2 Post-SB24228: Add oil up to "MIN" level.

CAUTION: MAKE SURE FILLER CAP IS LOCKED SECURELY. CAPS NOT INSTALLED CORRECTLY CAN CAUSE COMPLETE LOSS OF OIL.

(c) Install filler cap in filler neck. Make sure cap is correctly installed and locked securely. Wipe off any spilled oil.

(3) If oil tank contents are below minimum level of dipstick or sight glass, proceed as follows:

(a) Check for external leakage and repair as necessary.

(b) Service oil tank, fill to "MIN" level only.

(c) Install filler cap in filler neck. Make sure cap is correctly installed and locked securely.

(4) On engines which have remained stationary for a period of 12 hours or more, check oil tank contents but do not service with oil. If oil level is low, fill to "MIN" level only.

G. Oil System Drainage (Ref. Fig. 302)

NOTE: 1. Recommendations for oil change intervals are based on the performance of specific brands and types of oil, specific engine models and operating criteria. General oil change intervals may be extended periodically and will be reflected by revisions to Chapter 05-20-00, SCHEDULED MAINTENANCE CHECKS.

NOTE: 2. Permission for extension of oil drain intervals may be granted to operators through monitoring programs conducted by most major oil companies which have been approved by Pratt & Whitney Canada. Chapter 72-00-00, DESCRIPTION AND OPERATION will be revised accordingly to include newly approved oils.

(1) Place suitable containers or drip pan under engine.

(2) Remove oil filler cap.

(3) Drain oil tank by removing oil cover (13), located on pressure oil pump body, with puller (PWC43172).

(4) Pre-SB24485:

(a) Drain AGB oil by removing the chip detector valve housing (4) using puller (PWC37728) from adapter (7).

(b) Lubricate new preformed packing (6) with engine oil (PWC03-001), install on chip detector valve housing (4) and install assembly in adapter (7). Torque housing 200 to 225 lb.in. (22.6-25.4 Nm) and install lockwire (PWC05-089).

(c) Remove oil filter cover and withdraw element (Ref. 79-20-01).

(d) Replace oil filter element if necessary (Ref. 79-20-01).

(e) Fill oil filter cover with specified clean oil, fit new preformed packings and install on engine.

(5) Drain Cover (Post-SB24485):

(a) Removal:

1 Remove bolt (18), washer (17).

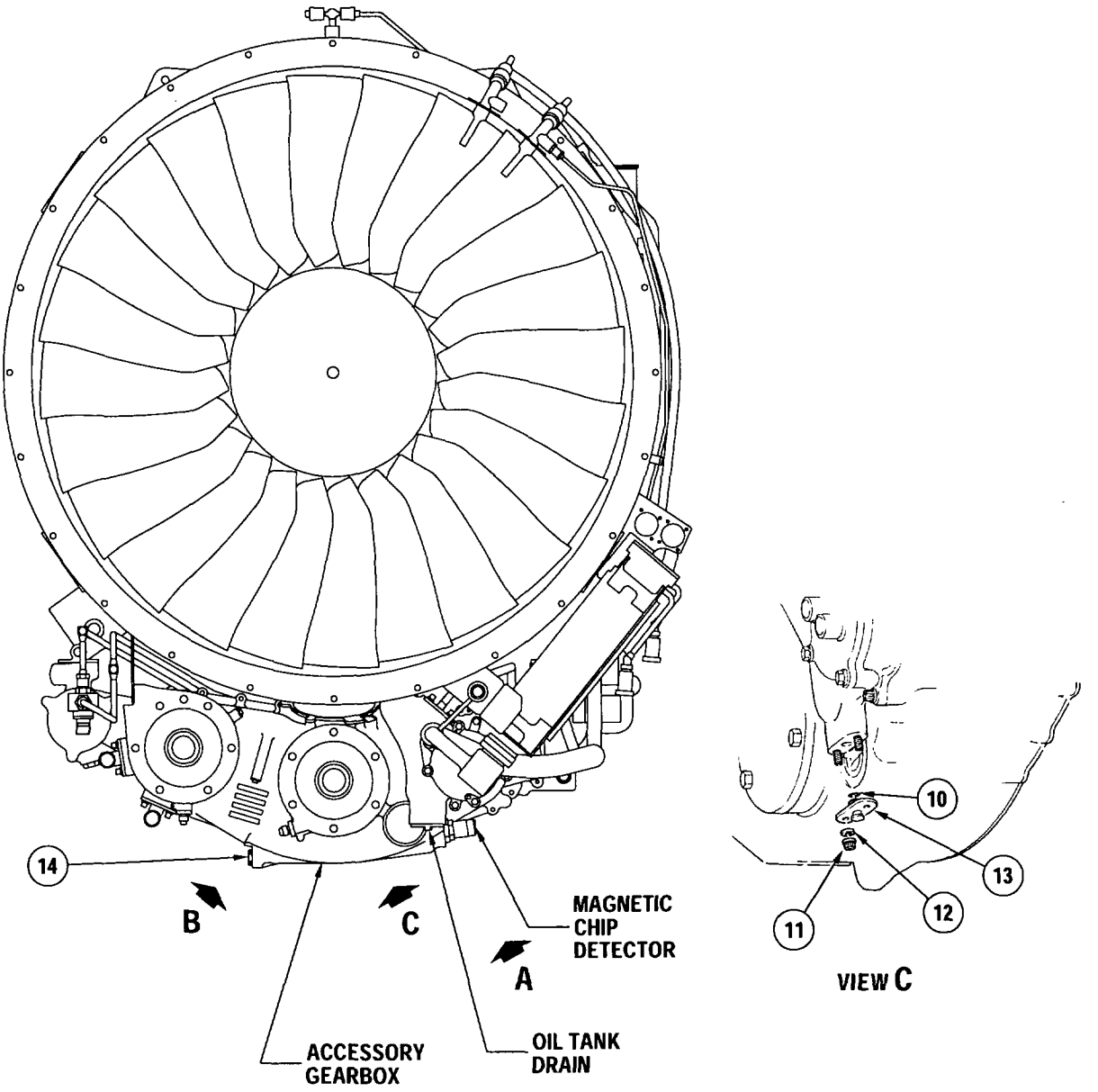
2 Remove drain cover (16) with puller (PWC66103).

3 Remove and discard packing (15).

4 Drain oil from the AGB.

(b) Installation:

1 Install preformed packing (15) on oil drain cover (16).



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Location of Oil Drains
Figure 302 (Sheet 1 of 2)

Key to Figure 302

1. Magnetic Chip Detector
2. Preformed Packing
3. Preformed Packing
4. Chip Detector Valve Housing
5. Bolt
6. Preformed Packing
7. Adapter
8. Preformed Packing
9. Strainer Element
10. Preformed Packing
11. Self-locking Nut
12. Washer
13. Cover (Oil Tank Drain)
14. Drain Plug (Pre-SB24485)
15. Preformed Packing (Post-SB24485)
16. Drain Cover (Post-SB24485)
17. Washer (Post-SB24485)
18. Bolt (Post-SB24485)

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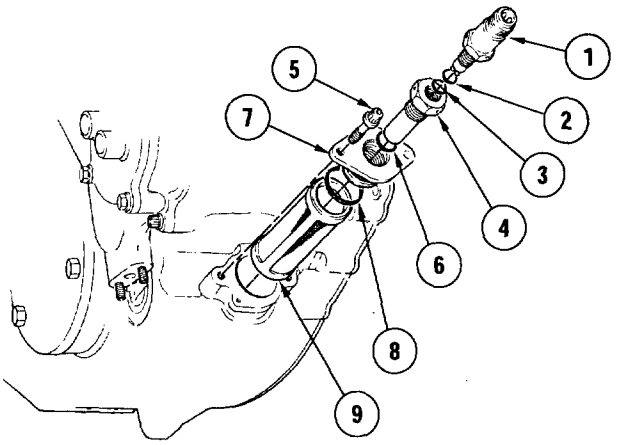
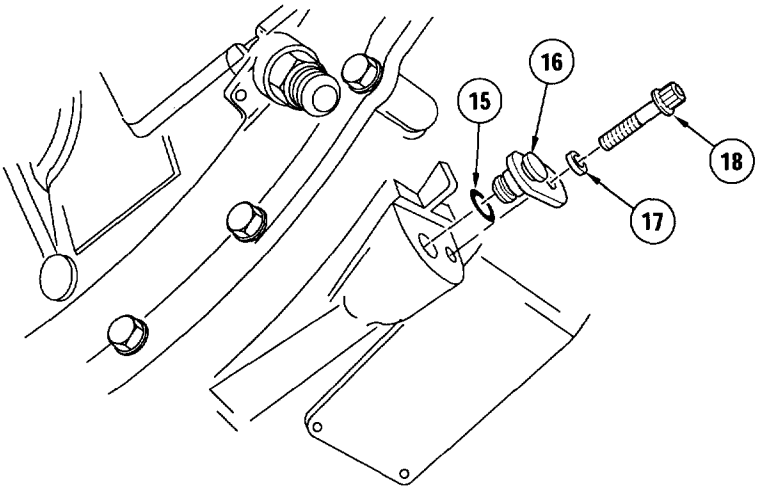


PRE-SB24485
VIEW A



POST-SB24485
VIEW B

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Location of Oil Drains
Figure 302 (Sheet 2)

2 Lubricate bolt threads with engine oil (PWC03-001). Install oil drain cover at the base of the AGB.

3 Secure the oil drain cover with bolt (18) and washer (17). Torque bolt 36 to 40 lb.in. (4.1-4.5 Nm).

H. Oil System Filling

(1) Lubricate preformed packing (10) with engine oil (PWC03-001), install on cover (13) and insert cover into oil pump housing with two washers (12) and two self-locking nuts (11). Torque 23 to 26 lb.in. (2.6-2.9 Nm) and install lockwire (PWC05-089).

(2) Relocated to Para. G., Oil System Drainage.

(3) Relocated to Para. G., Oil System Drainage.

(4) Relocated to Para. G., Oil System Drainage.

(5) Relocated to Para. G., Oil System Drainage.

(6) Refill oil tank with specified clean oil.

(7) Record the type and brand of oil used in the engine logbook.

(8) Start engine (Ref. 71-00-00 ADJUSTMENT/TEST) and run at ground idle for 15 minutes.

I. Oil System Flushing

(1) If an engine is to be operated with an oil brand or type which differs from that on which it previously operated, or if the oil system has been contaminated by other than metallic matter, flush the system as follows:

(a) Place suitable container or drip pan under engine.

(b) Drain engine oil (Ref. Para. G., Oil System Drainage).

(c) Refill oil system (Ref. Para. H., Oil System Filling).

(d) Start engine (Ref. 71-00-00 ADJUSTMENT/TEST) and run at stabilized IDLE for five minutes.

(e) Shut down engine (Ref. 71-00-00 ADJUSTMENT/TEST), drain and refill oil system.

P&WC Proprietary Information. Subject to the restrictions on the title page.

J. Chip Detector Inspection (Ref. Fig. 302)

(1) Remove chip detector (1) from chip detector valve housing (4) in accessory gearbox. Remove and discard preformed packings (2 and 3).

NOTE: 1. The chip detector is a two part, self closing type, mounted in an adapter secured to the accessory gearbox. It is not normally necessary to remove the detector valve housing (4) and adapter (7). If necessary, remove adapter with puller (PWC37728).

NOTE: 2. Do not clean magnetic plug prior to inspection.

(2) Inspect the magnetic chip detector (1) and chip detector housing (4) for metal particles. If metal particles are not present, proceed to step (a). If metal particles are found, refer to Chapter 79-20-01, Debris in Oil System Inspection.

(a) Clean magnetic chip detector and valve housing with clean, lint-free cloth as follows:

CAUTION: DO NOT SOAK CHIP DETECTOR IN SOLVENT.

1 Seal electrical receptacle.

2 Clean with petroleum solvent (PWC11-027) and a medium stiff-bristle brush or spray.

3 Make sure magnets are free of metal particles. Store detector in sealable container until ready for use.

(b) Visually check valve seat for oil leakage. If oil leakage is present, proceed as follows:

1 Drain oil from AGB (Ref. Para. G., Oil System Drainage).

CAUTION: BECAUSE OF THE SIZE OF WRENCH THAT WOULD NORMALLY BE USED FOR THE CHIP DETECTOR BODY, OVERTIGHTENING CAN EASILY OCCUR. THEREFORE, USE OF A TORQUE WRENCH IS RECOMMENDED TO AVOID OVERTIGHTENING AND TO PREVENT FRACTURE OF CHIP DETECTOR BODY.

2 Install new preformed packings (2 and 3) on chip detector body (1) and install assembly. Tighten detector body 90 to 100 lb.in. (10.1-11.3 Nm) and install lockwire (PWC05-089).

(c) Install airframe cable connector.

(d) Refill engine oil tank (Ref. Para. H., Oil System Filling).

K. Relocation of Oil Filler Neck

(1) Procedure transferred to Paragraph "Conversion of Engine for LH or RH Installation".

6. Preparation for Storage and Service

A. Shipping Container

(1) Description

(a) The fiberboard shipping container comprises a wooden skid base, to which is secured a metal cradle, a fiberboard sleeve sandwiching a plywood stiffener forming the sides of the container and a fiberboard cover sandwiching a plywood stiffener. The base, cradle and associated hardware are reusable, the fiberboard sleeve and cover being disposable. The container is intended for domestic shipment in a closed conveyance on the North American continent or for overseas shipment by air and is not intended for shipment by sea.

(b) The container is weather resistant only and should not be exposed to climatic conditions for more than seven days and must not be used for outdoor storage. It also offers protection against corrosion for a period of up to six months, provided that the container is correctly sealed and sheltered indoors in relatively dry area and the color of humidity indicator is monitored every 15 days.

(2) Humidity Control

(a) To maintain internal conditions within the protective envelope, at a safe humidity level for storage, twelve bags of desiccant material are placed in the protective envelope. Each desiccant bag contains eight units (one unit equals one ounce).

(b) A humidity indicator is installed within the protective envelope and is visible through a window in the fiberboard casing. The moisture level can thus be checked without disturbing the container or its contents. At a safe humidity level (up to 40 percent relative humidity) the indicator color is blue. As humidity increases, the color gradually changes to pink. An all pink color indicates that an unsafe moisture condition has been reached; the desiccant must then be replaced with freshly activated bags, (Ref. Subpara. D.. following).

(3) Refer to Table 302 for fiberboard shipping container data.

TABLE 302, Shipping Container Data

Description	Data
Length	92 in. (234 cm)
Width	55 in. (140 cm)
Height	60 in. (152 cm)
Weight (approx.)	892 lbs. (406 kg)

B. Precautions

(1) When an engine is to be removed from or installed in a fiberboard container, the following precautions must be taken:

(a) Ensure that a hoist of sufficient lifting capacity, plus safety factor, is available to lift loads as follows:

1 PW305 Engine - a load of 1350 lb (614 kg) when lifting engine only.

2 PW305 Engine encased in container-2500 lb (1136 kg).

(b) Ensure that container or engine is positioned correctly on floor, directly beneath hoist.

(c) Ensure that free overhead space of at least ten feet is available, exclusive of distance from top of container or engine to hook.

C. Removal of Engine from Container (Ref. Figs. 303 and 304)

NOTE: Adjust lifting-eye of sling to ensure horizontal lift.

CAUTION: IF ENGINE IS DROPPED RETURN ENGINE TO AN APPROVED OVERHAUL FACILITY.

(1) Cut and remove strapping (1, Fig. 303) from around fiberboard container, retain corners (2) remove cover (3) and sleeve (4) from base (5).

(2) Cut protective envelope (6) and expose top of engine.

CAUTION: NEVER USE ENGINE SLING AND LIFTING BRACKETS TO LIFT AN ENGINE THAT IS STILL ATTACHED TO SKID BASE.

(3) Install sling (1, Fig. 304), and attach yoke to two lifting brackets (2) at front flange of intermediate case (Flange B). Attach yoke to rear lifting brackets (3), on Flange E.

CAUTION: LIFT ENGINE SQUARELY OUT OF THE CONTAINER. IF REQUIRED ADJUST THE SLING.

(4) Lift engine enough to remove four bolts (10) and washers (11), from LH front engine support (12).

(5) Remove cotterpin (9), washer (8) and pin (4) and remove support (12) away from engine.

(6) Remove lockwire and remove quick-release pin (13) from support (18).

(7) Remove lockwire and two quick-release pins (26) from rear supports (20).

CAUTION: DO NOT ALLOW ENGINE TO CONTACT ANY PART OF SHIPPING CONTAINER WHEN LIFTING ENGINE.

(8) Raise engine clear of skid and base assembly.

(9) Remove envelope containing engine log book and relevant records from folding box on skid assembly.

(10) Move skid assembly away from engine.

(11) Remove front RH and LH mount brackets (7 and 19) from intermediate case.

(12) If engine is to be installed in an aircraft determine if engine is to be LH or RH installation.

(13) Relocate oil filler neck (Ref. Para. 9. A.) if necessary.

(14) Relocate engine mounts and mount pad covers (Ref. Para. 9. B.) if necessary.

D. Reactivation of Desiccant and Humidity Indicator

(1) Place bags of desiccant and humidity indicator in a suitable oven controlled at 121°C (250°F). The humidity indicator may be removed when an all blue color has been attained. The desiccant bags should remain in the oven for two hours minimum.

(2) Allow oven to cool to room temperature (approximately 22°C (72°F)) and then remove bags and indicator as applicable.

(3) Immediately place desiccant bags in airtight polyethylene envelopes. Exclude all air and heat-seal envelopes.

NOTE: Desiccant bags must be removed from polyethylene bags prior to installation in shipping/storage container.

E. Installation of Engine in Shipping Container (Ref. Fig. 304)

CAUTION: MAKE SURE THAT OIL HAS BEEN COMPLETELY DRAINED FROM ENGINE.

(1) Ensure that cradle and skid base are serviceable and that a new or serviceable fiberboard sleeve, plywood sides and lid are available.

(2) Ensure interior of protective envelope is absolutely clean and not damaged.

(3) Check condition of attaching hardware (if required use new hardware).

CAUTION: DO NOT USE STANDARD COMMERCIAL HARDWARE TO SECURE ENGINE SUPPORT BRACKETS TO ENGINE OR CONTAINER. USE OF HARDWARE OF LOWER STRENGTH THAN SPECIFIED COULD CAUSE SERIOUS ENGINE DAMAGE DURING SHIPPING.

(4) Refer to Para. 6. B. for hoist capacities.

(5) Apply anti-seize compound (PWC06-004) on threads of the bolt (27) that attach the nose cone cover and strap support plate assembly to fan case (Ref. Section E-E).

(6) Install the nose cone cover (30) on the fan case with bolts (27), washers (28) and nuts (29).

(7) Torque bolts 27 to 30 lb.in. (3.1-3.4 Nm).

(8) Make sure all shipping covers are installed on engine.

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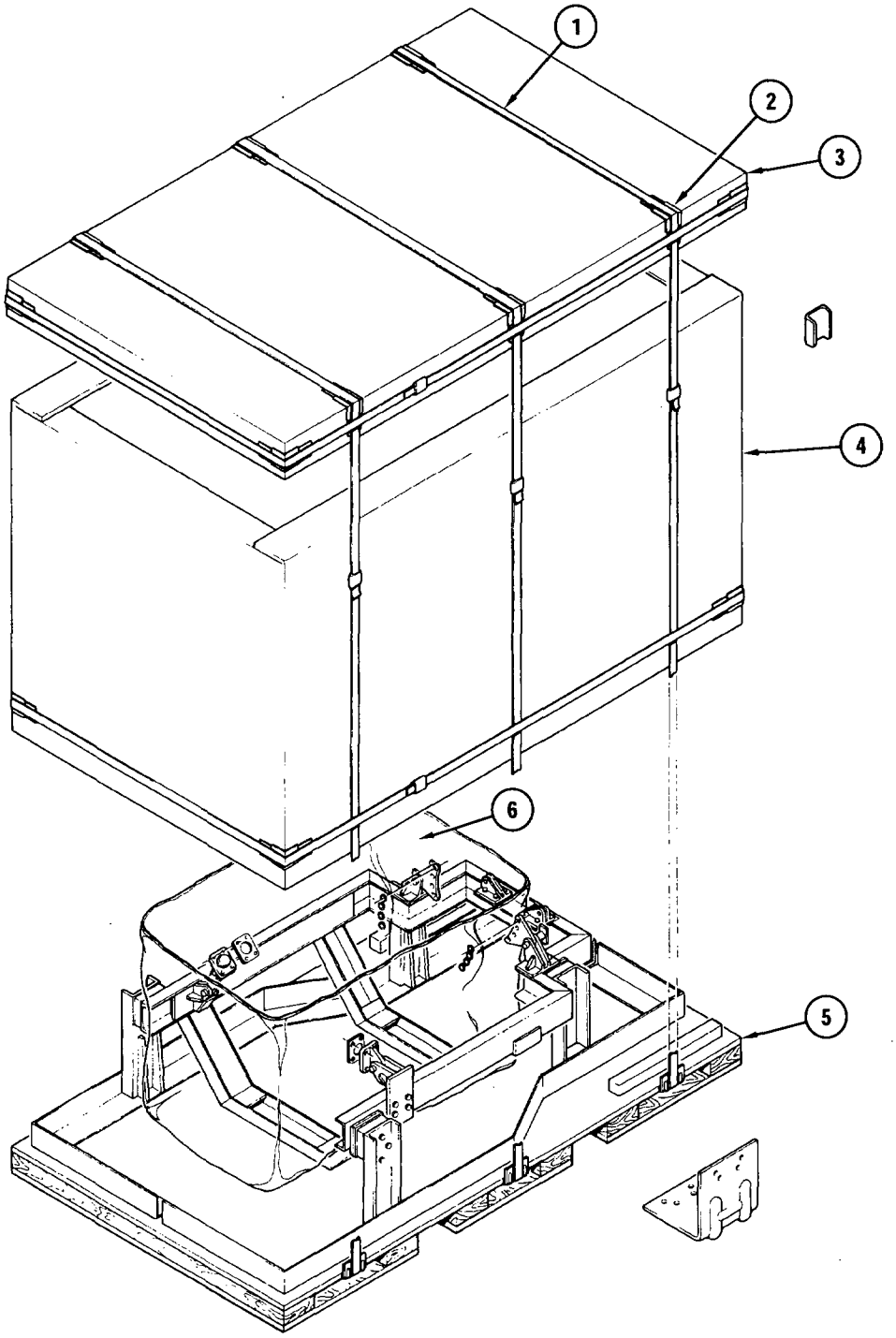

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Fiberboard Shipping Container
Figure 303

Key to Figure 303

1. Strapping
2. Corners
3. Cover
4. Sleeve
5. Base
6. Envelope

(9) Place engine log book, log sheets and other relevant papers to be shipped with engine, in a waterproof envelope and seal with pressure sensitive tape (PWC05-069). Place this material in box and place in shipping container. Secure with pressure sensitive tape.

(10) Raise engine using sling (1).

(11) Remove LH or RH mount pad cover as applicable, and install LH and RH mount brackets (7 and 19) on intermediate case using four bolts (5) and washers (6) supplied. Tighten 350 to 475 lb.in. (48.0-53.7 Nm) and install lockwire (PWC05-089).

(12) Assemble LH front engine support (12) to LH mount bracket (7) on intermediate case, using pin (4), washer (8) and cotterpin (9).

(13) Install adjustable rods (21) on lugs of exhaust case using pins (24), washers (23) and cotterpins (22).

(14) Install humidity indicator (Ref. IPC) into envelope such that it can be aligned with window in container sleeve.

CAUTION: USE CARE TO ENSURE FUEL/OIL HEAT EXCHANGER IS NOT DAMAGED WHEN INSTALLING ENGINE IN CRADLE.

(15) Lower engine into cradle.

(16) Attach LH front engine support (12) to cradle with four bolts (10) and washers (11). Tighten 720 to 800 lb.in. (80-90 Nm).

(17) Install quick release pin (13) to secure RH front support and install lockwire (PWC05-089).

(18) Adjust length of adjustable rods (21) as necessary to locate in rear engine supports (20).

(19) Verify proper thread engagement of adjustable rods by inserting a piece of lockwire (PWC05-089) into inspection holes. The wire must not pass through.

(20) Tighten nut (25), if rods were adjusted, 275 to 300 lb.in. (32-34 Nm).

(21) Install quick release pins (26) in rear engine supports (20) and install lockwire (PWC05-089).

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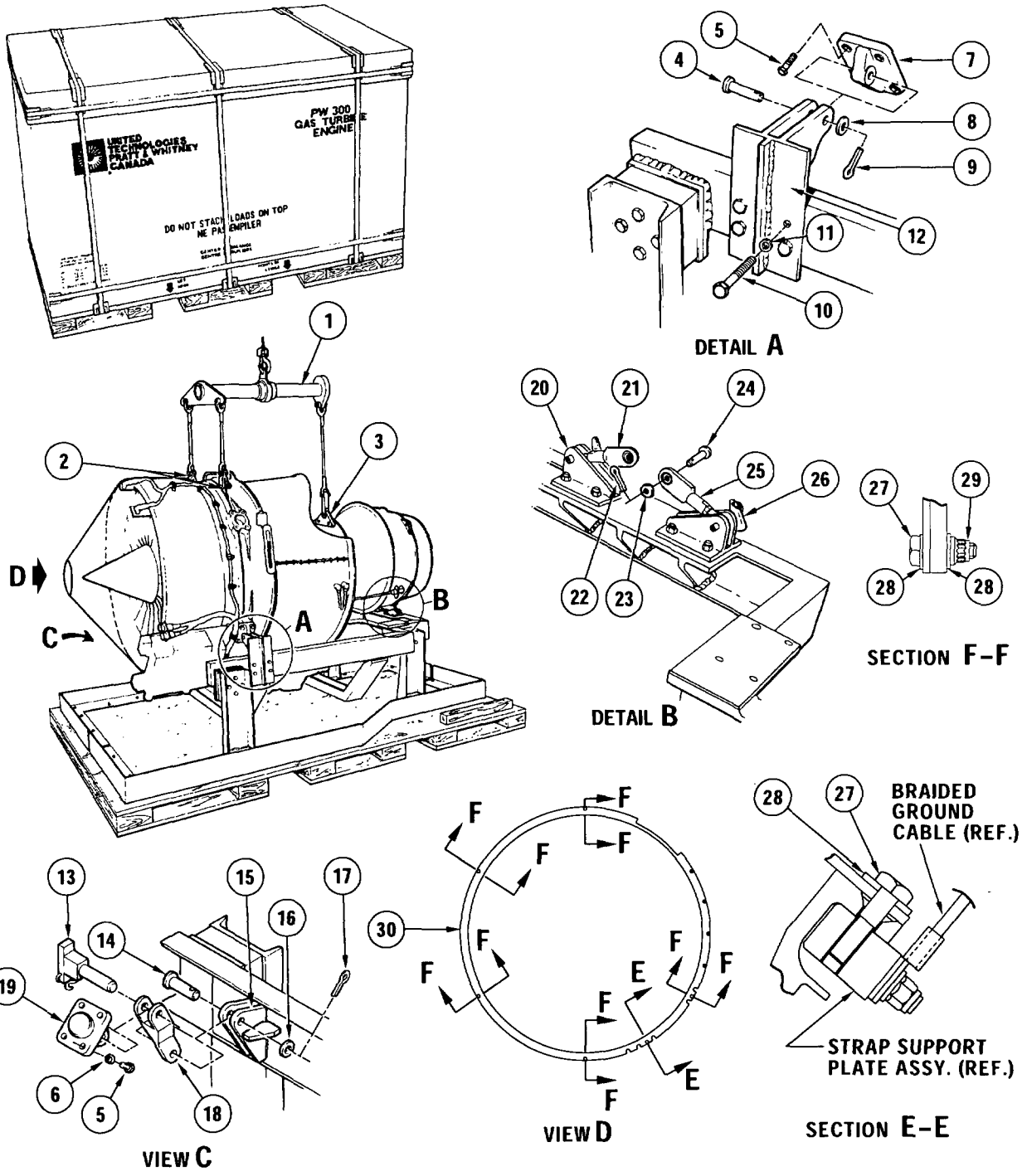

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Engine in Shipping Container - Removal/Installation
Figure 304

Key to Figure 304

1. Sling (PWC66106)
2. Front Lifting Bracket
3. Rear Lifting Bracket
4. Pin
5. Bolt
6. Washer
7. LH Mount Bracket (Intermediate Case)
8. Washer
9. Cotterpin
10. Bolt
11. Washer
12. LH Front Engine Support
13. Quick-release Pin
14. Pin
15. RH Front Engine Support
16. Washer
17. Cotterpin
18. Support
19. RH Mount Bracket (Intermediate Case)
20. Rear Engine Support
21. Adjustable Rod
22. Cotterpin
23. Washer
24. Pin
25. Nut
26. Quick-release Pin
27. Bolt
28. Washer
29. Nut
30. Nose Cone Cover

(22) Disconnect sling from engine.

(23) Tie 12 bags of desiccant (Ref. IPC) to the engine, evenly distributed along length of engine.

(24) Evacuate and heat seal engine envelope. Fold envelope to align humidity indicator (Ref. IPC) with window on fiberboard container.

(25) Install fiberboard sleeve over engine. Close and seal sleeve flaps with pressure sensitive tape (PWC05-070).

(26) Install fiberboard cover and seal with pressure sensitive tape (PWC05-070).

(27) Strap container with two horizontal and three vertical sets of ¾ inch steel strapping (PWC05-063) and fit 20 corners, as applicable.

7. Preservation/Depreservation

A. General

Fuel system preservation can only be done when the engine is installed on the aircraft (or test cell), because activation of the metering valve in the HMU can only be achieved by a powered up EEC. It is therefore recommended that any engine that will be removed from the aircraft for heavy maintenance, with the possibility of being returned to an overhaul facility, be preserved in accordance with the procedure below.

The procedure to be followed for the preservation of engines in service depends on the period of inactivity and whether or not the engine may be rotated during the inactive period (engines installed in aircraft only). The expected period of inactivity should be established and reference made to the Engine Preservation Schedule. The extent of preservation carried out **must** be recorded in the engine log book and on tags secured to the engine.

B. Preservation

(1) The following engine preservation schedule lists procedures to be followed:

CAUTION: UNDER NO CIRCUMSTANCES SHOULD PRESERVATIVE OIL BE SPRAYED INTO COMPRESSOR OR TURBINE ENDS OF ENGINES. DIRT PARTICLES DEPOSITED ON BLADES AND VANES COULD ADHERE AND ALTER THE AIRFOIL SHAPE, ADVERSELY AFFECTING ENGINE EFFICIENCY.

(a) 0 to 7 days - Engines may be left in an inactive state, with no preservation protection, provided engine is sheltered, humidity is not excessively high and engine is not subjected to extreme temperature changes which would produce condensation.

(b) 8 to 28 days - Engine inactive for up to 28 days, require no preservation provided all engine openings are sealed off and relative humidity in engine is maintained at less than 40 percent. Humidity control is maintained by placing desiccant bags and humidity indicator on wooden racks in engine exhaust duct. Suitable windows must be provided in exhaust closure to facilitate observation of humidity indicators.

(c) 29 to 90 days - Engine inactive for a period exceeding 28 days, but less than 90 days, need only to have fuel system preserved (Ref. step (2) following), engine intake and exhaust opening covered, and desiccant bags and humidity indicators installed.

(d) 91 days and over - Engines inactive 91 days and more in airframe, or removed for long term storage in container, must, in addition to 29 and 90 day procedures, have engine oil drained. Remove cover plates from unused accessory drive pads and spray exposed surfaces and gearshafts with engine oil(PWC03-001). Replace cover plates.

(2) Carry out preservation of engine fuel system (engine inactive for more than 28 days) as follows:

CAUTION: EXTREME CARE MUST BE TAKEN TO PREVENT FOREIGN MATERIAL FROM BEING DRAWN INTO ENGINE FUEL SYSTEM. EQUIPMENT MUST BE SUPPLIED WITH SUITABLE FILTERS NO COARSER THAN 10 MICRON RATING.

(a) Close airframe supply and disconnect fuel inlet supply to fuel pump.

(b) Remove four bolts and disconnect primary and secondary fuel lines from fuel dump valve inlet and discard preformed packings.

(c) Install suitable flexible line from each tube to drain into an open waste container.

(d) Connect preservative oil (PWC05-077) supply line to fuel pump inlet.

(e) Inject preservative oil at a pressure of 30 to 60 psig (207 to 414 kPa) and a temperature of 16°C (60°F).

CAUTION: OBSERVE STARTER MOTOR OPERATING LIMITS.

(f) Perform a 30 second wet motoring run (Ref. 71-00-00, ADJUSTMENT/TEST), except do not use airframe fuel boost pump. Make sure preservative oil is flowing from both fuel lines into waste container. Repeat if necessary.

(g) Turn off preservative oil supply and reduce supply pressure to 0 psig.

(h) Drain preservative oil from fuel filter housing by removing drain plug at bottom of housing.

(i) Lubricate new preformed packing with engine oil (PW03-001), install preformed packing on drain plug and install drain plug in fuel filter housing. Tighten 65 to 75 lb.in. (7.5-8.5 Nm) and install lockwire (PWC05-089).

(j) Lubricate new preformed packings with engine oil (PW03-001), install preformed packings on primary and secondary fuel lines and install on fuel dump valve. Install two bolts at each line, tighten 36 to 40 lb.in. (4.0-4.6 Nm).

(k) Disconnect preservative oil supply line from fuel pump inlet and cap to avoid entry of contaminants.

(l) Check for external preservative oil leaks.

(m) Tag engine and power control lever in aircraft cabin, as applicable, with a warning prohibiting cranking of engine and include date of preservation of engine.

C. Depreservation

(1) Depreservation Schedule

(a) 0 to 7 days - No depreservation required.

(b) 8 to 28 days - Desiccant and moisture barriers must be removed. Ensure that all previously sealed engine openings are reopened and are unobstructed.

(c) 29 to 90 days - Remove engine intake and exhaust covers together with desiccant and humidity indicators. Depreserve engine fuel system.

(d) 91 days and over - Engine must be completely depreserved and lubrication system serviced.

(2) Depreservation Procedure

(a) Fill engine oil tank with approved oil (Ref. Oil System Filling).

NOTE: The lubricating oil system does not require any depreservation procedures.

(b) Remove four bolts and disconnect primary and secondary fuel lines from fuel dump valve inlet and discard preformed packings.

(c) Install suitable flexible line from each tube to drain into an open waste container.

(d) Connect airframe fuel supply to fuel pump inlet.

CAUTION: OBSERVE STARTER MOTOR OPERATING LIMITS.

(e) Perform a 30 second wet motoring run (Ref. 71-00-00 ADJUSTMENT/TEST) and ensure clean airframe supplied fuel is flowing from both fuel lines. Repeat if necessary, momentarily selecting TLA from idle to CUT-OFF detents to assist in fuel system purging.

(f) Install new preformed packings on primary and secondary fuel lines and install on fuel dump valve. Secure with bolts at each line, tighten and torque 36 to 40 lb.in. (4.0-4.6 Nm).

(g) Check for external leaks.

8. Removal/Installation of Engine from/in Maintenance Stand

A. Removal (Ref. Fig. 305)

(1) Install sling (PWC66106), straps (PWC60181) and chain hoist on the engine and take up the weight.

CAUTION: DO NOT LET ENGINE CONTACT ANY PART OF ENGINE STAND WHEN RAISING.

(2) Remove four bolts (4) from lower support bracket (PWC60838) and 4 bolts (5) from upper support bracket (PWC60839) and remove the engine.

(3) If engine is to be installed in an aircraft determine if engine is to be LH or RH installation.

(4) Relocate oil filler neck (Ref. Para. 9. A.) if necessary.

(5) Relocate engine mounts and mount pad covers (Ref. Para. 9. B.) if necessary.

B. Installation (Ref. Fig. 305)

(1) Make sure the wheels on stand (1) (PWC66300) or (PWC40453) are locked.

CAUTION: DO NOT LET ENGINE CONTACT ANY PART OF ENGINE STAND WHEN LOWERING.

(2) Lift the engine with sling (PWC66106), straps (PWC60364) and chain hoist and position on maintenance stand (1) (PWC66300) or (PWC40453).

NOTE: Bolts (6 and 7) on support brackets (2) and (3) must be finger tight.

(3) Install lower support bracket (2) (PWC60838) with four bolts (4). Tighten finger tight.

(4) Install upper support bracket (3) (PWC60839) with four bolts (5). Tighten finger tight.

(5) Torque bolts (4, 5, 6 and 7) 275 to 300 lb.in. (31-33 Nm).

(6) Remove the sling.

9. Conversion of Engine for LH or RH Installation

NOTE: Left hand or right hand installation of the engine on the aircraft may require relocation of the following hardware.

A. Relocation of Oil Filler Neck (Ref. Figs. 306, 307, 308 and 309)

(1) If engine installation requires repositioning of oil filler neck to opposite side of engine, drain oil until it is below level of filler neck connection with intermediate case, and proceed as follows for:

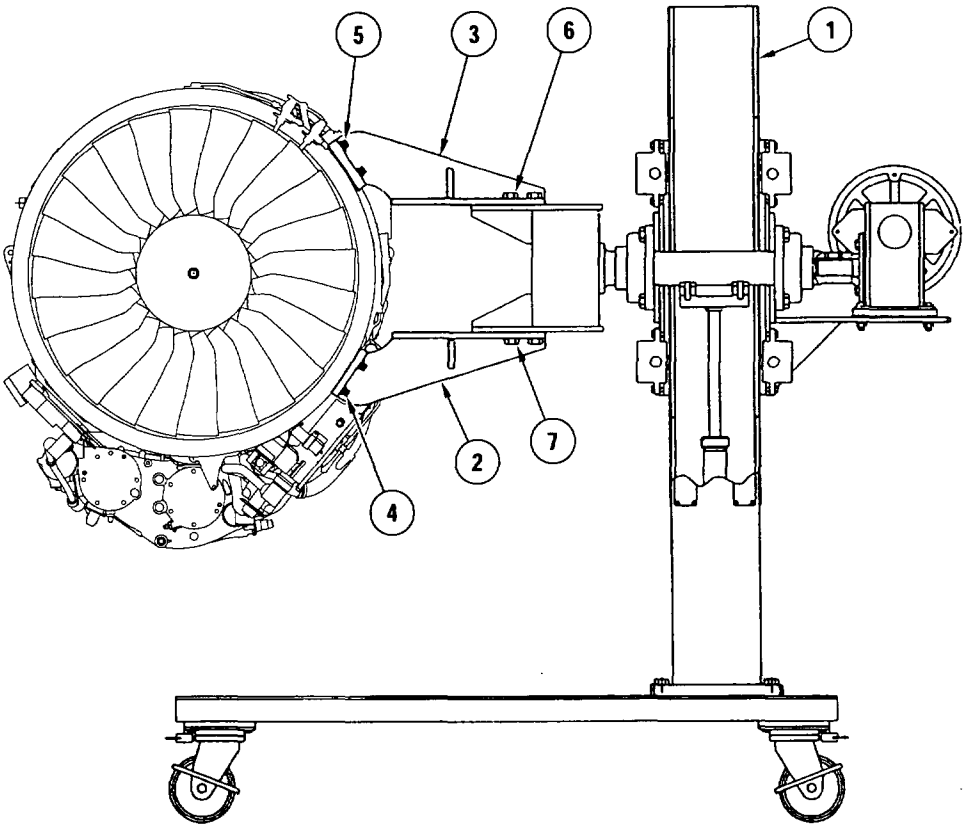
(2) Pre-SB24021 (Ref. Fig. 306)

(a) Remove two bolts (3) and bracket (2) that attach filler neck (1) to intermediate case (9).

(b) Remove two bolts (5) from bottom of filler neck and remove filler neck and dipstick assembly from engine. Discard preformed packing (6).

(c) From opposite side of intermediate case, remove two bolts (8) and washers (9) and remove cover plate (7). Discard preformed packing (6).

(d) Install new preformed packing (6) on filler neck assembly (1) and install on opposite side of intermediate case with two bolts (5). Install bracket (2) with two bolts (3). Tighten and torque bolts (5 and 3) 36 to 40 lb.in. (4.1-4.5 Nm).



C65335

Engine on Maintenance Stand (Typical)
Figure 305

P&WC Proprietary Information. Subject to the restrictions on the title page.

Key to Figure 305

1. Maintenance Stand
2. Lower Support Bracket
3. Upper Support Bracket
4. Bolt
5. Bolt
6. Bolt
7. Bolt

(e) Install new preformed packing (6) on cover plate (7) and attach to intermediate case, in place of filler neck, with two bolts (8) and washers (9). Tighten and torque 36 to 40 lb.in. (4.1-4.5 Nm).

(3) PW305A Pre-SB24578 (Ref. Fig. 308)

(a) Remove two bolts (3) and bracket (2) that attach filler neck (1) to intermediate case (9).

(b) Remove two bolts (5) from bottom of filler neck and remove filler neck (1) and dipstick assembly (4) from engine. Discard preformed packing (7).

(c) Remove retaining ring (10), strainer element (8) and ball (11) from oil filler neck (1). Discard preformed packing (6).

(d) Install ball (11), strainer element (8) and retaining ring (10) in the oil filler neck (1).

(e) Install new preformed packing (6) on filler neck assembly (1) and install on opposite side of intermediate case with two bolts (5). Install bracket (2) with two bolts (3). Tighten and torque bolts (5 and 3) 36 to 40 lb.in. (4.1-4.5 Nm).

(f) Install new preformed packing (7) on filler cap and dip stick assembly (4). Install filler cap on oil filler neck assembly (1).

(4) PW305A Only - Relocation of Vent Tube (Ref. Fig. 306)

(a) Remove bolt (16), nut (19), washer (17), bracket (14) and loop clamp (15).

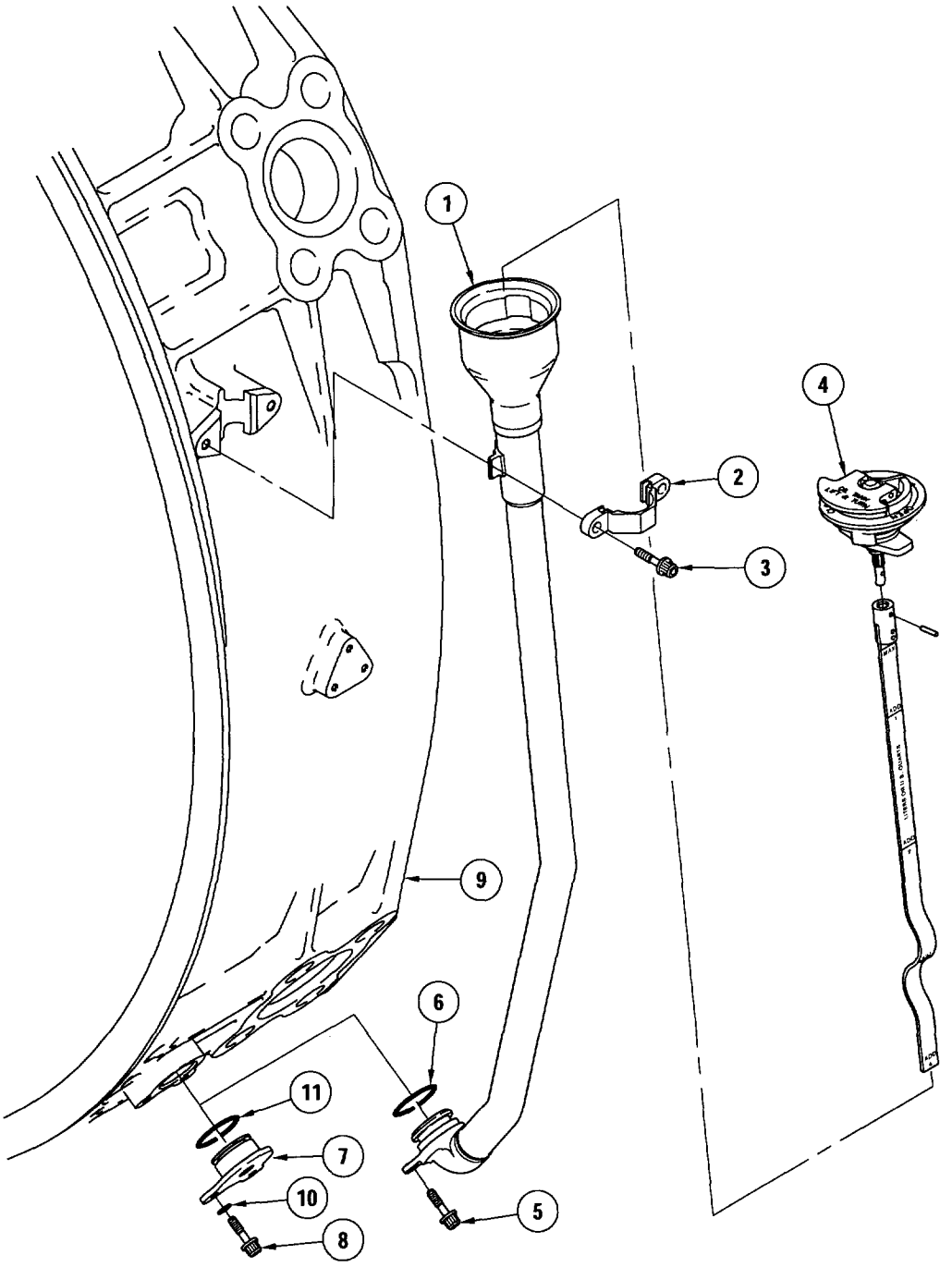
(b) Loosen fitting (18) and disconnect elbow of vent tube (13).

(c) Remove bolts (12) and remove tube (13). Remove and discard packing (25).

(d) Remove bolts (21) and (28) and remove pressure indicator/housing assembly (24), (27) with bracket (29).

(e) Re-install bolt (16), washer (17) and nut (19). Add another washer (20) on the other side of Flange C to compensate for removed bracket (14). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

P&WC Proprietary Information. Subject to the restrictions on the title page.



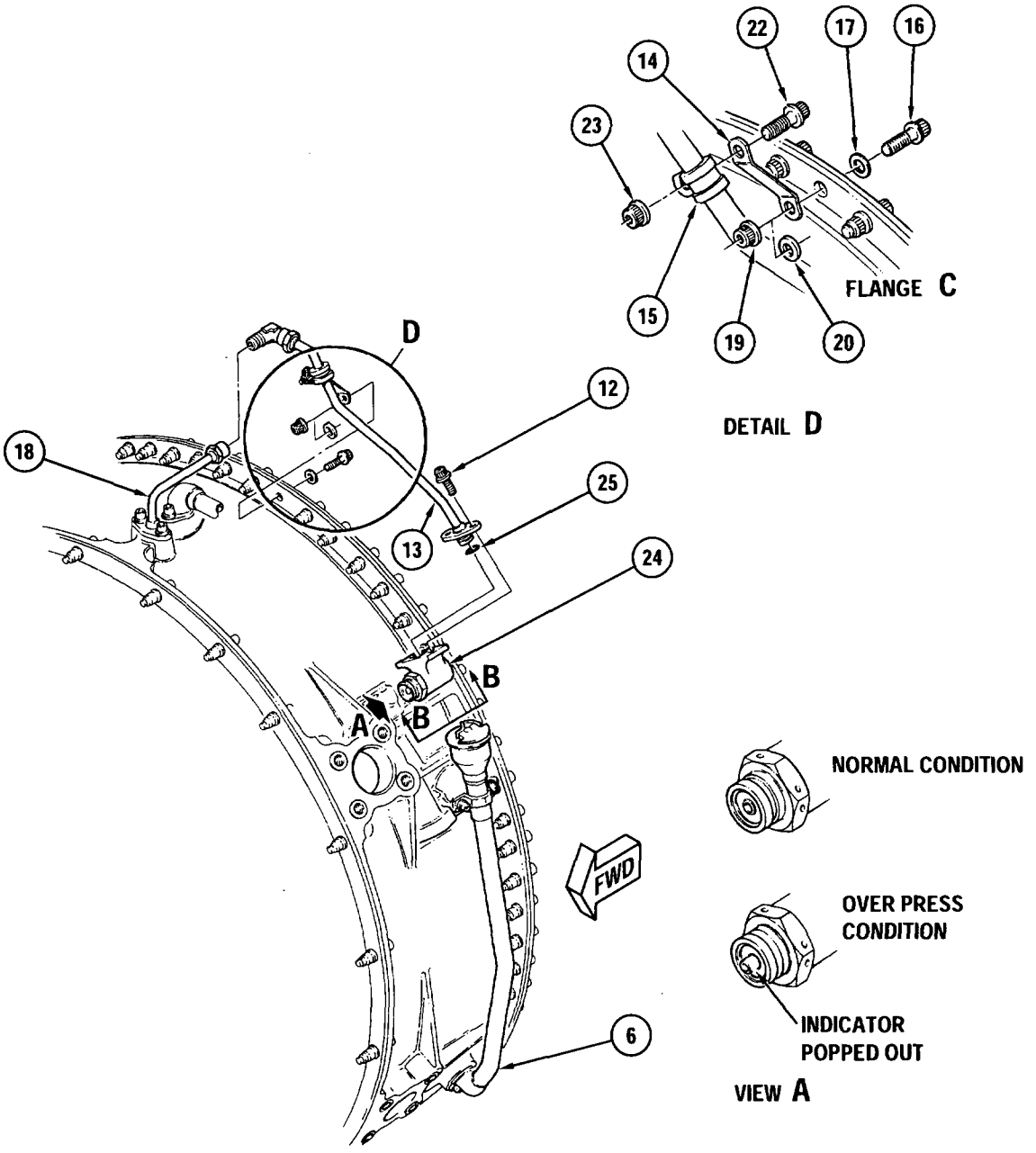
C18686C

Relocation of Oil Filler Neck (Filler Cap and Gage Assembly)
Figure 306 (Sheet 1 of 3)

Key to Figure 306

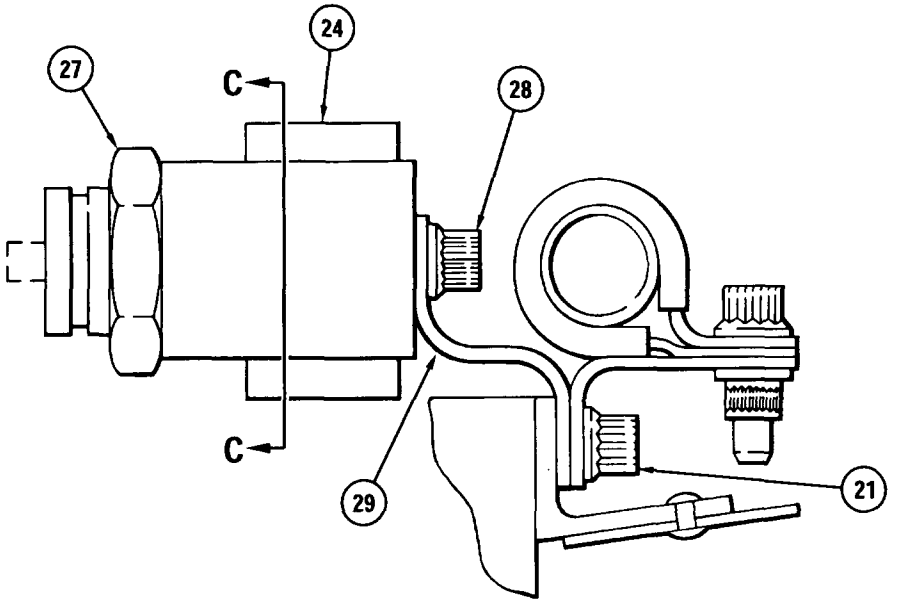
1. Oil Filler Neck
2. Bracket
3. Bolt
4. Filler Cap and Dipstick Assembly
5. Bolt
6. Preformed Packing
7. Cover Plate
8. Bolt
9. Intermediate Case
10. Washer
11. Preformed Packing
12. Bolt
13. Vent Tube
14. Bracket
15. Loop Clamp
16. Bolt
17. Washer
18. Fitting
19. Nut
20. Washer
21. Bolt
22. Bolt
23. Nut
24. Indicator Housing
25. Preformed Packing
26. Bolt
27. Differential Oil Pressure Indicator
28. Bolt
29. Bracket

P&WC Proprietary Information. Subject to the restrictions on the title page.

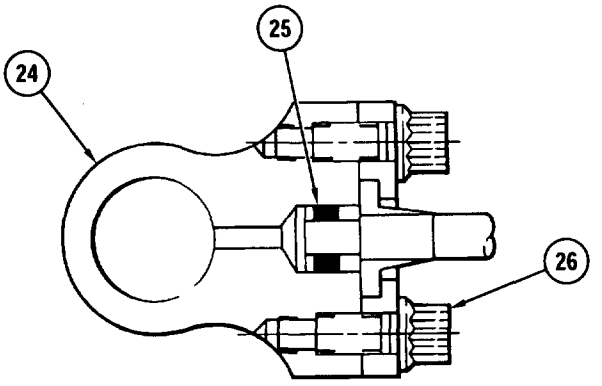


C21719

Relocation of Oil Filler Neck (Filler Cap and Gage Assembly)
Figure 306 (Sheet 2)



VIEW B-B

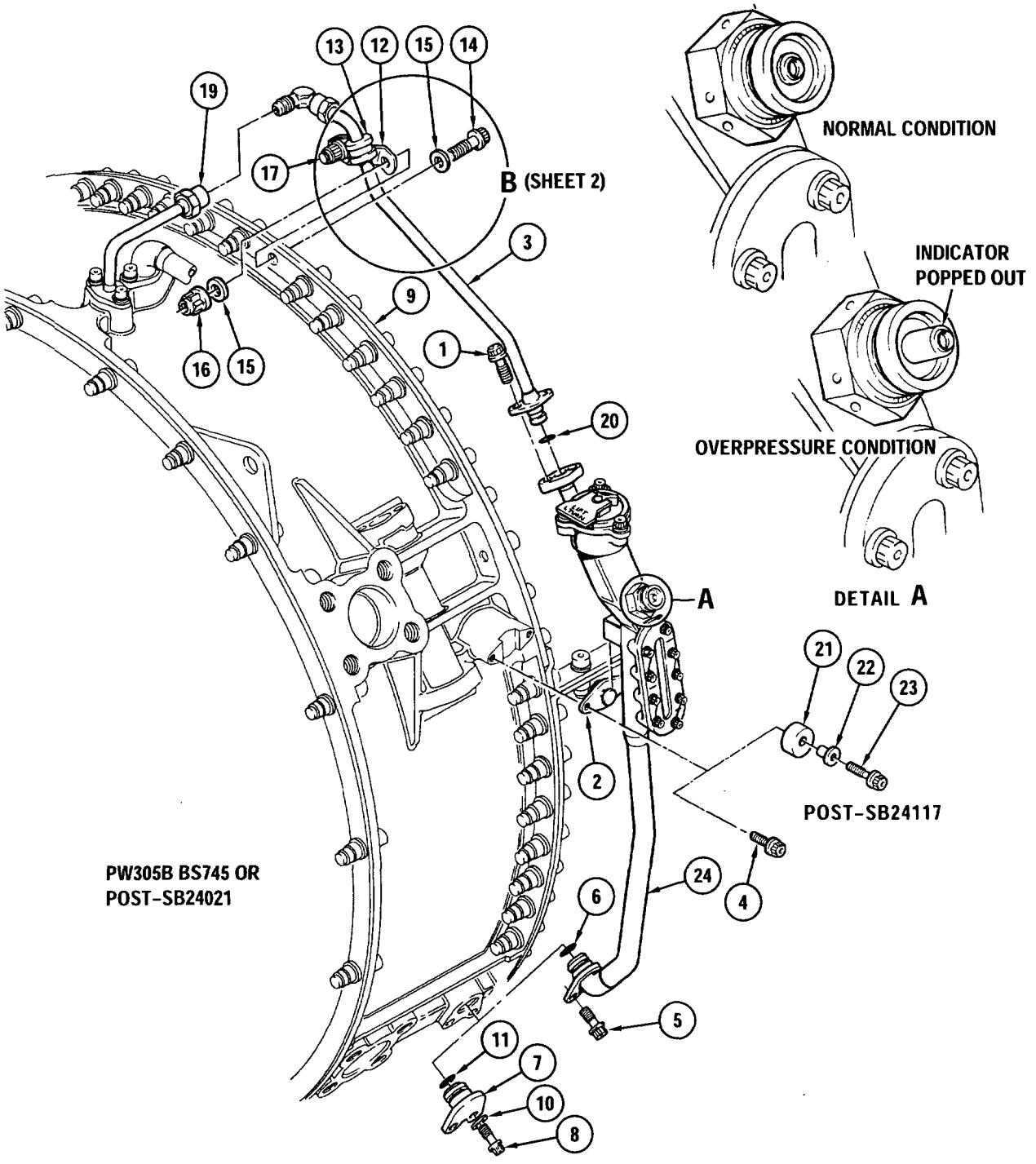


SECTION C-C

PW305A ONLY

C21718

Relocation of Oil Filler Neck (Filler Cap and Gage Assembly)
Figure 306 (Sheet 3)



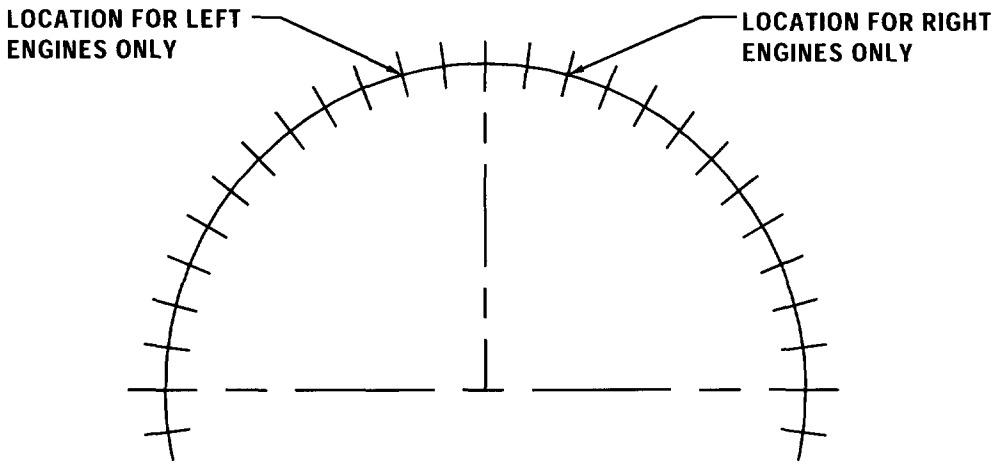
C21266B

Relocation of Oil Filler Neck (Sightglass)
Figure 307 (Sheet 1 of 2)

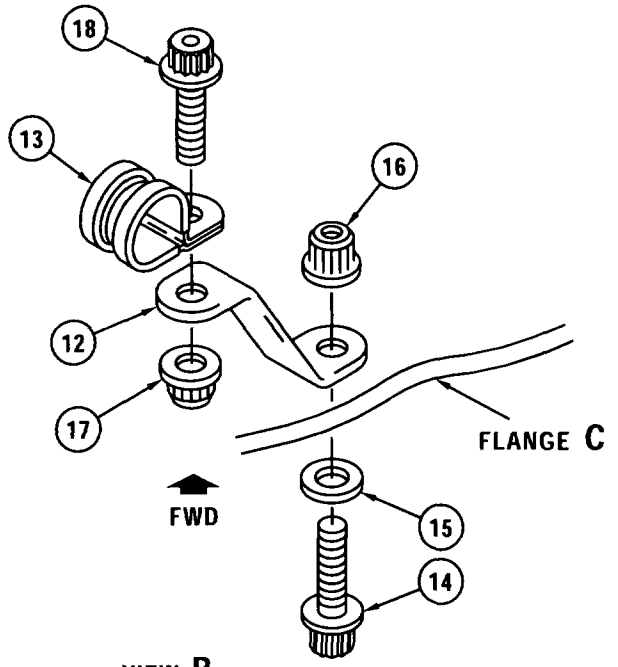
Key to Figure 307

1. Bolts
2. Bracket
3. Vent Tube
4. Bolts
5. Bolts
6. Preformed Packing
7. Cover
8. Bolts
9. Intermediate Case
10. Washer
11. Preformed Packing
12. Bracket
13. Loop Clamp
14. Bolt
15. Washer
16. Nut
17. Nut
18. Bolt
19. Fitting
20. Preformed Packing
21. Rubber Support (Post-SB24117)
22. Sleeve (Post-SB24117)
23. Bolt (Post-SB24117)
24. Filler Neck

P&WC Proprietary Information. Subject to the restrictions on the title page.



VIEW LOOKING FORWARD ON FLANGE C
SHOWING BOLT LOCATIONS



VIEW B
POST-SB24021

C32822

Relocation of Oil Filler Neck (Sightglass)
Figure 307 (Sheet 2)

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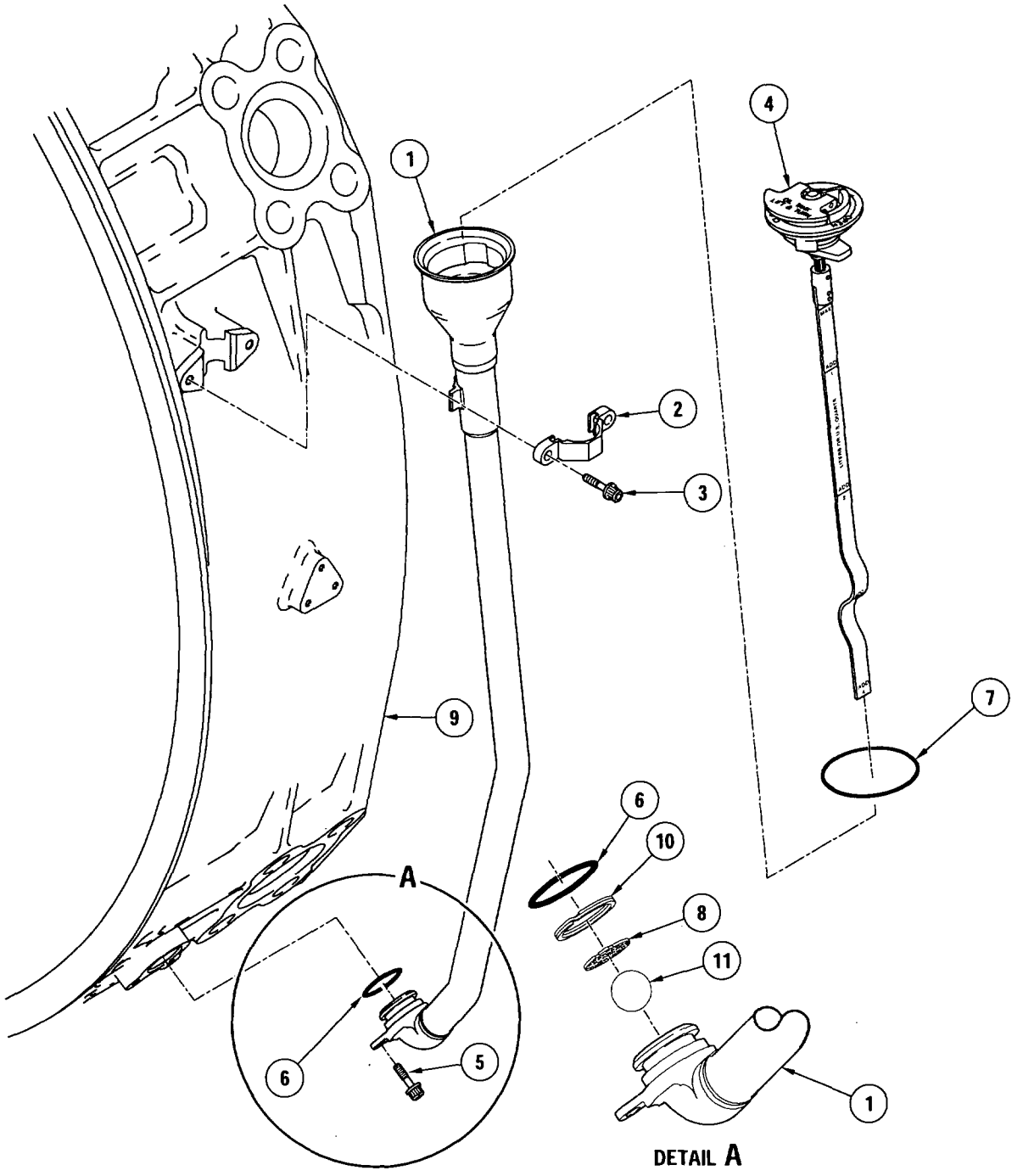


C149820

Relocation of Oil Filler Neck - (PW305A Pre-SB24578)
Figure 308

Key to Figure 308

1. Oil Filler Neck
2. Bracket
3. Bolt
4. Filler Cap and Dipstick Assembly
5. Bolt
6. Preformed Packing
7. Preformed Packing
8. Strainer Element
9. Intermediate Case
10. Retaining Ring
11. Ball

(f) Relocate vent tube assembly (13) to the opposite side and pressure indicator/housing assembly (24), (27) with associated attaching parts. Torque bolts as follows:

1 Bolts (12), (26), (28) - Torque 24 to 36 lb.in. (2.7-4.1 Nm).

2 Bolts (16), (22) - Torque 27 to 30 lb.in. (3.1-3.4 Nm).

3 Bolt (30) - Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(5) Post-SB24021 (Ref. Fig. 307)

(a) Remove two bolts (1) securing vent tube to filler neck assembly (3).

(b) Disconnect elbow of vent tube (3) from fitting (19).

(c) Remove nut (17), bolt (18) and clamp (13) from vent tube.

(d) Remove vent tube (3) and discard packing (20) from lower end of vent tube.

(e) Remove nut (16) and bracket (12).

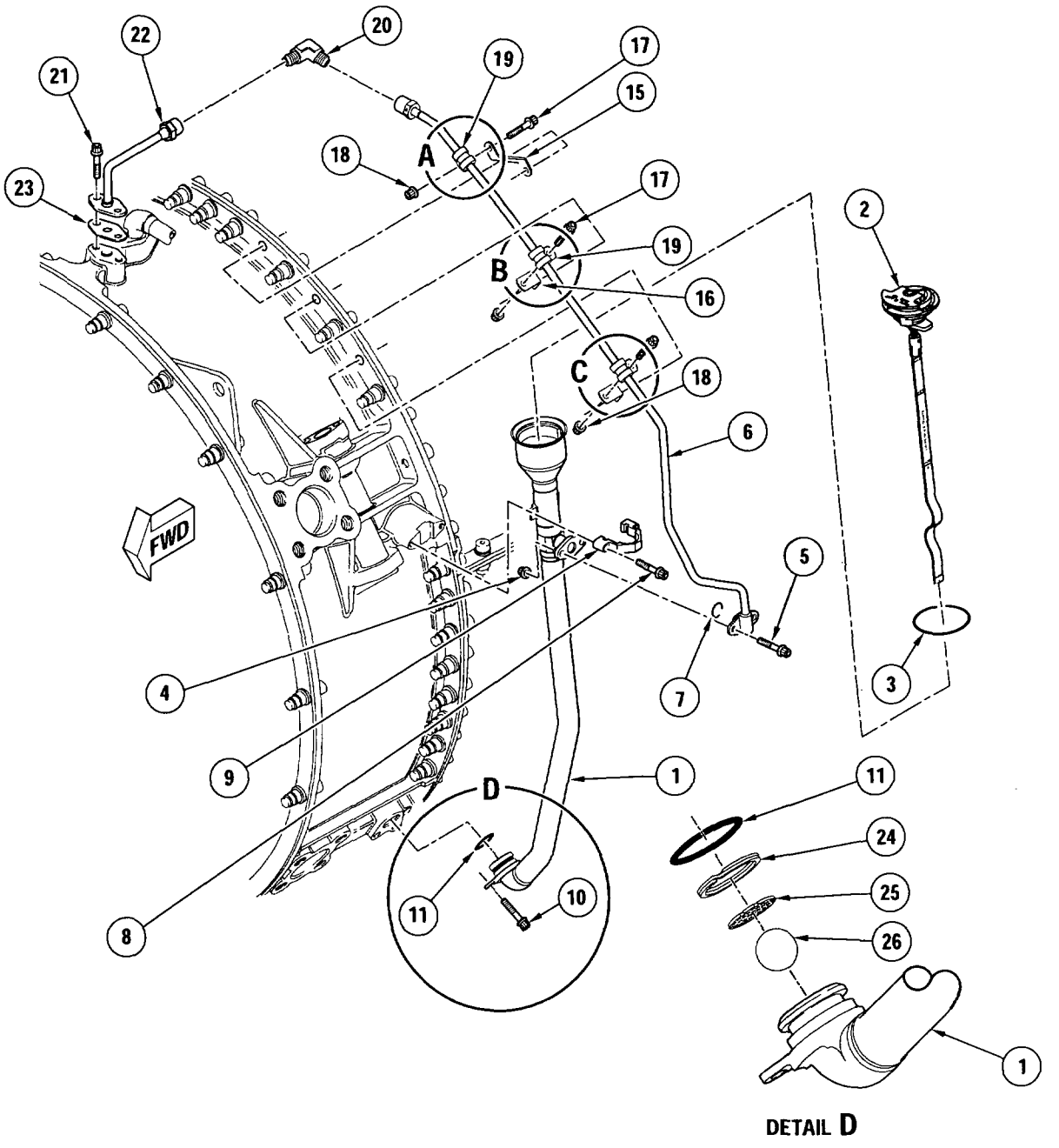
(f) Fit second washer (15) on bolt and re-install nut (16). Torque 27 to 30 lb.in. (3.1-3.4 Nm).

(g) Remove filler neck assembly (24) as follows:

1 Pre-SB24117 - Remove two bolts (5), two bolts (23), and remove filler neck. Remove and discard packing (6).

2 Post-SB24117 - Remove two bolts (5), two bolts (23), two sleeves (22) and two rubber supports (21), and remove filler neck (24).

(h) Remove two bolts (8), cover plate (7) from the other side of the engine. Remove and discard packing (11).



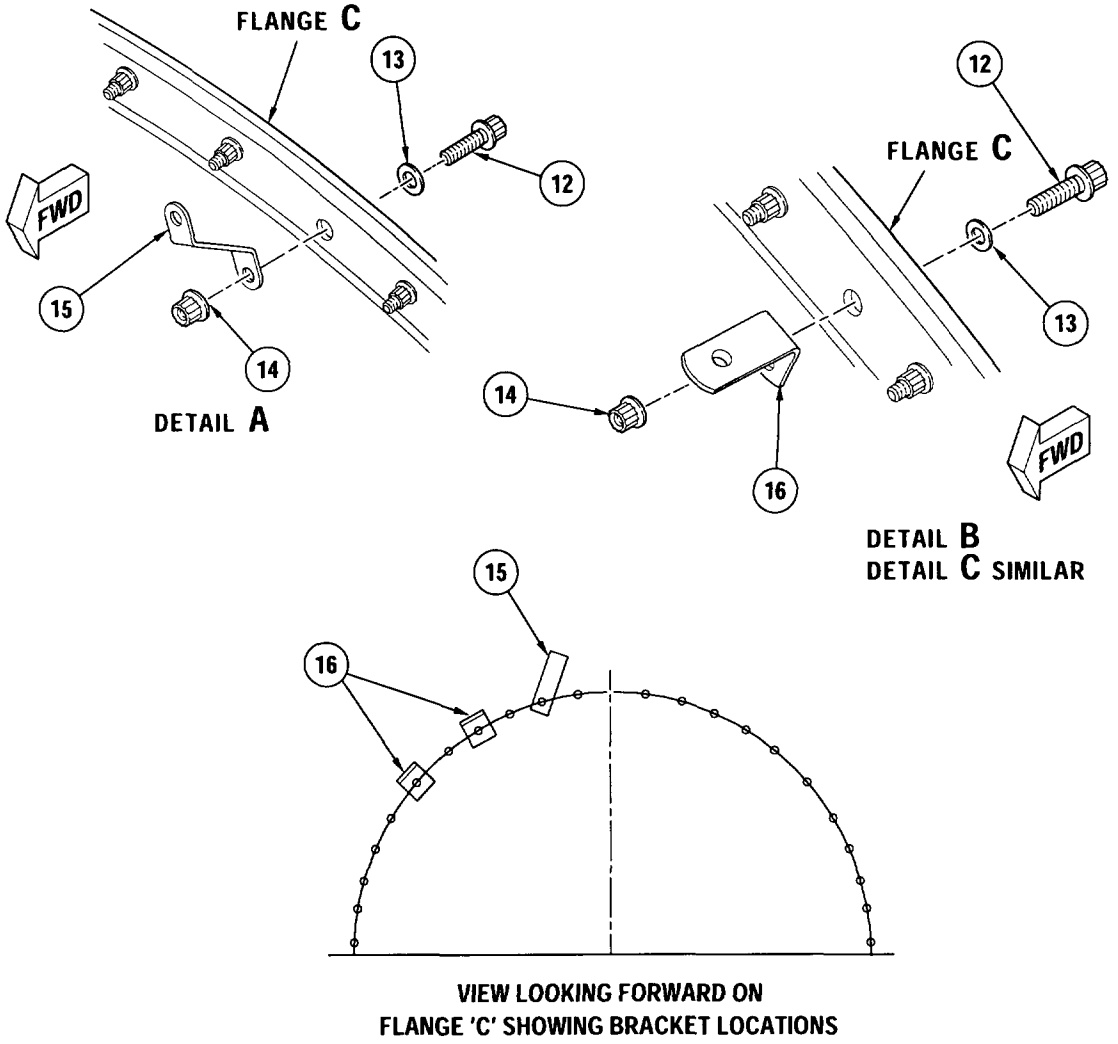
C149501A

Relocation of Oil Filler Neck and Vent Tube - (PW305A Post-SB24578)
Figure 309 (Sheet 1 of 2)

Key to Figure 309

1. Oil Filler Neck Assy
2. *Oil Tank Filler Cap and Gage Assy*
3. Preformed Packing
4. Nut
5. Bolt
6. Vent Tube Assy
7. Preformed Packing
8. Bolt
9. Filler Neck Mount Bracket
10. Bolt
11. Preformed Packing
12. Bolt
13. Washer
14. Nut
15. Loop Clamp Bracket
16. Bracket
17. Bolt
18. Nut
19. Loop Clamp
20. Elbow
21. Bolt
22. Oil Tank Vent Tube Assy
23. Gasket
24. Retaining Ring
25. Strainer Element
26. Ball

P&WC Proprietary Information. Subject to the restrictions on the title page.



C149502

Relocation of Oil Filler Neck and Vent Tube - (PW305A Post-SB24578)
Figure 309 (Sheet 2)

(i) Post-SB24075 - Remove blanking plate from unused oil filler neck mounting pad on the other side of the engine.

(j) Fit new packing (6) on filler neck assembly (21) and install on opposite side of the intermediate case as follows:

1 Pre-SB24117 - Install filler neck (24) with bolts (5). Install bracket (2) of filler neck with bolts (23). Tighten 36 to 40 lb.in. (4.1-4.5 Nm).

2 Post-SB24117 - Install filler neck (24) with bolts (5). Install bracket (2) of filler neck with bolts (23), two sleeves (22) and two rubber supports (21). Tighten 36 to 40 lb.in. (4.1-4.5 Nm).

(k) Lubricate new preformed packing (20) with engine oil (PWC03-001), install on vent tube (3) and install on filler neck assembly (7) with two bolts (1). Tighten 24 to 36 lb.in. (2.7-4.1 Nm).

(l) Connect elbow to fitting (19). Torque 90 to 100 lb.in. (10-11 Nm) and install lockwire (PWC05-089) .

(m) Install bracket (12) at appropriate location on flange C with bolt (14) and nut (16) (Ref. Fig. 307, Sheet 2). Tighten 27 to 30 lb.in. (3.1-3.4 Nm).

(n) Install loop clamp (13) on vent tube (3) and fasten clamp to other end of bracket (12) with bolt (18) and nut (17). Tighten 27 to 30 lb.in. (3.1-3.4 Nm).

(o) Lubricate new packing (6) with engine oil (PWC03-001), install packing on cover plate (7) and install plate on intermediate case in place of the filler neck with two bolts (8) and washers (10). Tighten 36 to 40 lb.in. (4.1-4.5 Nm).

(6) PW305A Post-SB24578 - Relocation of Oil Filler Neck (Ref. Fig. 309)

(a) Remove two bolts (8) and filler neck mount bracket (9) that attach oil filler neck (1) to intermediate case.

(b) Remove two bolts (10) from bottom of filler neck and remove filler neck (1) and dipstick assembly (2) from engine. Discard preformed packing (3).

(c) Remove retaining ring (24), strainer element (25) and ball (26) from oil filler neck (1). Discard preformed packing (11).

(d) Install ball (26), strainer element (25) and retaining ring (24) in the oil filler neck (1).

(e) Install new preformed packing (11) on filler neck assembly (1) and install on opposite side of intermediate case with two bolts (10). Install bracket (9) with two bolts (8). Tighten and torque bolts 36 to 40 lb.in. (4.1-4.5 Nm).

(f) Install new preformed packing (3) on filler cap and dip stick assembly (2). Install filler cap on oil filler neck assembly (1).

(7) PW305A Post-SB24578 - Relocation of Vent Tube (Ref. Fig. 309)

(a) Remove oil filler neck and related parts from engine (Ref. 79-30-03, OIL FILLER NECK - MAINTENANCE PRACTICES).

(b) Install oil filler neck and related parts on engine (Ref. 79-30-03, OIL FILLER NECK - MAINTENANCE PRACTICES).

B. Relocation of Engine Mounts and Mount Pad Covers (Ref. Fig. 310)

(1) Remove engine mounts from the one and four o'clock position, RH side or the ten and eight o'clock position, LH side, as applicable (Ref. Aircraft Maintenance Manual).

(2) Remove bolts (3), washers (2) and mount pad covers (1) from the one and four o'clock position, RH side or the ten and eight o'clock position, LH side as applicable.

(3) Install engine mounts at the one and four o'clock position or the ten and eight o'clock position as applicable (Ref. Aircraft Maintenance Manual).

(4) Lubricate bolts (3) with engine oil (PWC03-001).

(5) Install mount pad covers (1) with washers (2) and bolts (3) at the one and four o'clock positions, or the ten and eight o'clock positions as applicable.

(6) Torque bolts (3) 36 to 40 lb. in., eight places, LH side or RH side, as applicable

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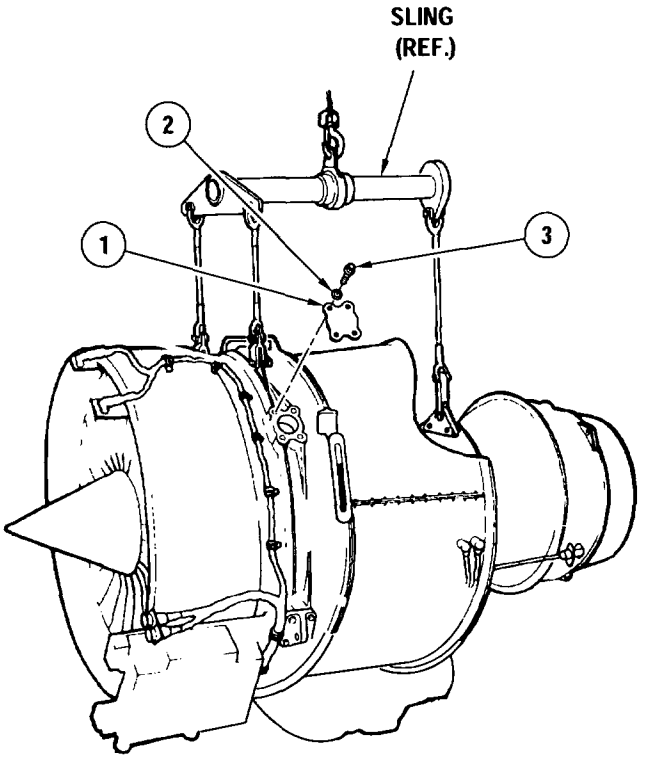


C86549

Engine Mounts and Mount Pad Covers - Relocation
Figure 310

Key to Figure 310

1. Cover
2. Washer
3. Bolt

ENGINE, GENERAL - INSPECTION

1. General

   A. Hot Section Inspection intervals, Engine Operating Time between Overhauls and Periodic Inspections are summarized in Chapter 05-20-00. Detailed inspection procedures are provided, where applicable, in the relevant INSPECTION/CHECK sections of subject chapters in this manual.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC05-018	Pencil, Metal Marking
PWC05-076	Oil, Penetrating
PWC05-097	Cleaner, Magnaflux
PWC05-226	Tape, Teflon

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC43671	Guide Tube
PWC43685	Guide Tube
PWC60758	Spacer
PWC60877	Guide Tube
PWC61592	Guide Tube

4. Fixtures, Equipment and Supplier Tools

   The fixtures, equipment and supplier tools listed below are used in the following procedures.

Name
Eddy Current Probe P/N US-1635
Eddy Current Probe P/N US-1645

5. Corrosion

   High temperature alloy corrosion may be identified as metal loss or pitting, but more usually appears as local swelling or buildup due to greater volume occupied by nickel oxides. These corrosion products vary in color from black to green and in the advanced state there will be cracking and flaking, referred to as exfoliation. Care should be taken to distinguish between corrosion buildup and possible light brown or rust-colored deposits which are essentially harmless combustion by-products. The latter are usually more widespread over hot section components and, while possibly affecting performance, will not directly affect compressor mechanical integrity.

6. Engine Overtemperature

Refer to Chapter 5-10-00.

7. Engine Overspeed

Refer to Chapter 5-10-00.

8. Engine Immersion in Water

Overhaul engine.

9. Engine Dropped During Handling

Overhaul engine.

10. Hot Section Inspection (HSI)

A. General

(1) The HSI procedure is broken down into major tasks as listed below. The tasks are arranged in accordance with the A.T.A.100 Chapter/Section/Subject numbering system and correspond with the same numbering system in the Illustrated Parts Catalog. Special tools and consumable materials required to do each major task are listed with the appropriate section.

(2) Inspection criteria for individual components which have been removed from the engine are provided in these sections. Refer to Borescope Inspection for inspection criteria of the complete engine.

B. Summary of HSI Disassembly Procedures

(1) Disconnect N1 speed probe wiring harness from N1/T4.5 terminal box (Ref. 77-20-01).

(2) Disconnect No. 4 bearing pressure and scavenge oil tubes from exhaust case (Ref. 79-20-03 and 79-20-04).

(3) Disconnect emergency fuel shut-off cable (Ref. 73-10-05).

(4) Disconnect and remove T4.5 "IN" wiring harness connections from N1/T4.5 terminal box (Ref. 77-20-01).

(5) Remove exhaust case (Ref. 72-50-03).

(6) Remove LP turbine module (Ref. 72-50-02).

(7) Remove HP turbines (Ref. 72-50-01).

NOTE: The first and second-stage HP turbines comprise a balanced assembly. Rejection of either turbine requires that both be returned to an approved overhaul facility for refurbishment and rebalancing, as required.

(8) Remove combustion chamber outer case, liner and first-stage HP turbine vane (Ref. 72-40-01).

C. Summary of HSI Inspection Criteria

(1) Refer to Table 601 for HSI inspection criteria.

TABLE 601, Hot Section Inspection

Component	Nature of Inspection
Exhaust Case (Ref. 72-50-03)	Cracks, nicks, dents and distortion.
Rear Fairing and Inner Cone (Ref. 72-50-03)	Cracks in welded seams.
LP Turbine Case (Ref. 72-50-02)	Cracks, nicks and dents. Coating loss, sulfidation and honeycomb seal disbonding. Evidence of isolated heat spots. Flange deformation. Clinch nut condition.
Third-stage Vane Assembly (Ref. 72-50-02)	Cracks, nicks, dents. Signs of coating loss and sulfidation. Condition of honeycomb seal. Condition of seal retaining rivets.
Fourth-stage Disk Hub (Ref. 72-50-02)	Cracks, nicks and dents. Condition of internal spline. Evidence of fretting.
Fourth-stage Blades and Vanes (Borescope) (Ref. 72-50-02)	Cracks, nicks, dents and sulfidation.
Fifth-stage Blades and Vanes (Borescope) (Ref. 72-50-02)	Cracks, nicks and dents.
Fifth-stage Disk Hub (Ref. 72-50-02)	Cracks, nicks and dents. Cracked or deformed blade retaining rivets.
First-stage HP Turbine Disk (Ref. 72-50-01)	Cracks, nicks, dents and security of balance counterweights.
Front and Rear HP Turbine Covers (Ref. 72-50-01)	Cracks, nicks and dents. Damaged knife edge seals. Cover deformation. Blocked or damaged cooling holes.
First-stage HP Turbine Blades	Cracks in blades. Signs of coating loss. Condition of cooling holes.
Second-stage HP Turbine Disk (Ref. 72-50-01)	Cracks, nicks, dents and security of balance counterweights.
Second-stage HP Turbine Blades (Ref. 72-50-01)	Cracks in blades. Signs of coating loss. Condition of cooling holes.
HP Turbine Baffle (Ref. 72-50-01)	Cracks, nicks, dents and blocked cooling holes.
HP Turbine Housing (Ref. 72-50-01)	Cracks, nicks, dents and blocked cooling holes.

TABLE 601, Hot Section Inspection (Cont'd)

Component	Nature of Inspection
Second-stage Turbine Vane Ring (Ref. 72-50-01)	Damage, cracks and honeycomb seal disbonding.
HP Turbine Shroud Segments (Ref. 72-50-01)	Cracks and buckling. Evidence of erosion, metal pick-up or heavy rubs.
First and Second-stage Shroud Retaining Rings (Ref. 72-50-01)	Cracks, distortion and fretting.
Second-stage Stator Seal Ring (Ref. 72-50-01)	Damage fretting or wear. Radial clearance and gaps when installed.
First-stage HP Turbine Vane Segments (Ref. 72-50-01)	Damage and blocked cooling holes.
Inner and Outer First-stage Vane Shrouds (Ref. 72-50-01)	Cracks nicks and dents.
Vane Retaining Plate (Ref. 72-50-01)	Cracks nicks and dents.
First-stage Stator Air Seal (Ref. 72-50-01)	Cracks. Honeycomb cell debonding.
First-stage Vane Seal Ring (Ref. 72-50-01)	Crack and distortion. Damage fretting or wear on faces. Radial clearance and gaps when installed.
Turbine Disk Air Nozzle (Ref. 72-50-01)	Cracks nicks and dents. Loose worn or damaged interstage turbine seal. Front and rear housing attaching rivets.
HP Turbine Spacer (Ref. 72-50-01)	Cracks and deformation.
HP Turbine Air Seal (Ref. 72-50-01)	Cracks nicks or dents.
Combustion Chamber Liner (Ref. 72-40-01 and 72-00-00, INSPECTION)	Cracks, distortion, fretting, hot spots, carbon buildup. Clean as required.
Fuel Nozzles (Ref. 73-10-04)	Carbon buildup.
Spark Igniters (Ref. 74-10-01)	Chafing and wear.
Oil Filter Element (Ref. 79-20-01)	Metal particles.
Chip Detector (Ref. 72-00-00)	Metal particles.
T4.5 Wiring Harness (Ref. 77-20-01)	General condition, functionality and resistance check.
N1 Speed Sensors (Ref. 77-10-01)	Replace.

D. Summary of HSI Assembly Procedures

(1) Assemble acceptable or replaced hot section components in accordance with the appropriate Chapter/Section/Subject.

(2) Install combustion chamber outer case and liner (Ref. 72-40-01).

(3) Install HP turbine (Ref. 72-50-01).

(4) Install LP turbine module (Ref. 72-50-02).

(5) Install exhaust case (Ref. 72-50-03).

(6) Install T4.5 "IN" wiring harness connections on N1/T4.5 terminal box (Ref. 77-20-01).

(7) Install No. 4 bearing pressure and scavenge oil tubes on exhaust case (Ref. 79-20-03 and 79-20-04).

(8) Connect N1 speed probe wiring harness to N1/T4.5 terminal box (Ref. 77-20-01).

(9) Install and rig emergency fuel shut-off cable (Ref. 73-10-05).

(10) Service oil system if necessary (Ref. 72-00-00, SERVICING).

(11) Perform required ground checks (Ref. 71-00-00 ADJUSTMENT/TEST).

11. Borescope Inspection

A. General

CAUTION: THE BORESCOPE IS A DELICATE DEVICE; IT IS CONSIDERED VULNERABLE TO SEVERE SHOCKS, TWISTING AND PINCHING. CARE AND ATTENTION MUST BE EXERCISED WHEN HANDLING IT SO AS TO PROLONG ITS SERVICE LIFE.

CAUTION: HEAT CAN SEVERELY DAMAGE FIBERSCOPE. BORESCOPE INSPECTION MUST BE ACCOMPLISHED AFTER ENGINE HAS COOLED TO ACCEPTABLE LEVEL (NORMAL COOL DOWN PERIOD IS 40 MINUTES FROM ENGINE SHUTDOWN). MAXIMUM SUGGESTED WORKING TEMPERATURE IS 66°C (150°F).

(1) The borescope is an optical device that enables an operator to perform visual inspections of the hot section and compressor areas of the engine while the engine remains installed in the airframe or at a ground handling installation, as applicable.

(2) The borescope equipment has the capability to take and store digital photographs on removable media so that a record may be made of the borescope inspection.

(3) Damage may be difficult to estimate through a borescope. It is therefore important that borescope inspection be performed by experienced personnel only.

(4) It is recommended that a compressor wash be performed (Ref. 71-00-00) prior to carrying out a borescope inspection.

(5) Rotation of the HP compressor and HP turbine for borescope inspection can be done by removing the AGB centrifugal breather outlet and installing a suitable hand crank having a 1/2 inch square drive.

(6) Borescope access to engine components can be achieved as outlined in Table 602, following:

TABLE 602, Borescope Access Ports (Ref. Fig. 601) and Inspection Schedule

Access Port	Inspection Area
Fan Inlet	VIGV
	First-stage HP Compressor
P2.5 Compressor Bleed Valve	Third-stage HP Compressor
	Fourth-stage HP Compressor
Igniter Boss	Fuel Nozzles
	Combustion Chamber Liner
	First-stage HP Turbine Vanes
	First-stage HP Turbine Blades
LP Turbine Case Boss	Second-stage HP Turbine Blades
	Third-stage LP Turbine Vanes
	Third-stage LP Turbine Blades
Exhaust Duct	Fifth-stage LP Turbine Vanes
	Fifth-stage LP Turbine Blades

B. Inspection Tables

Tables 603 through 613 show two levels of permissible damage. The first level permits continued operation with no change in the inspection interval. The second interval permits continued operation providing that repeat borescope inspections are performed at each subsequent MINOR inspection, to a maximum of 600 operating hours.

12. Variable Inlet Guide Vanes (VIGV)

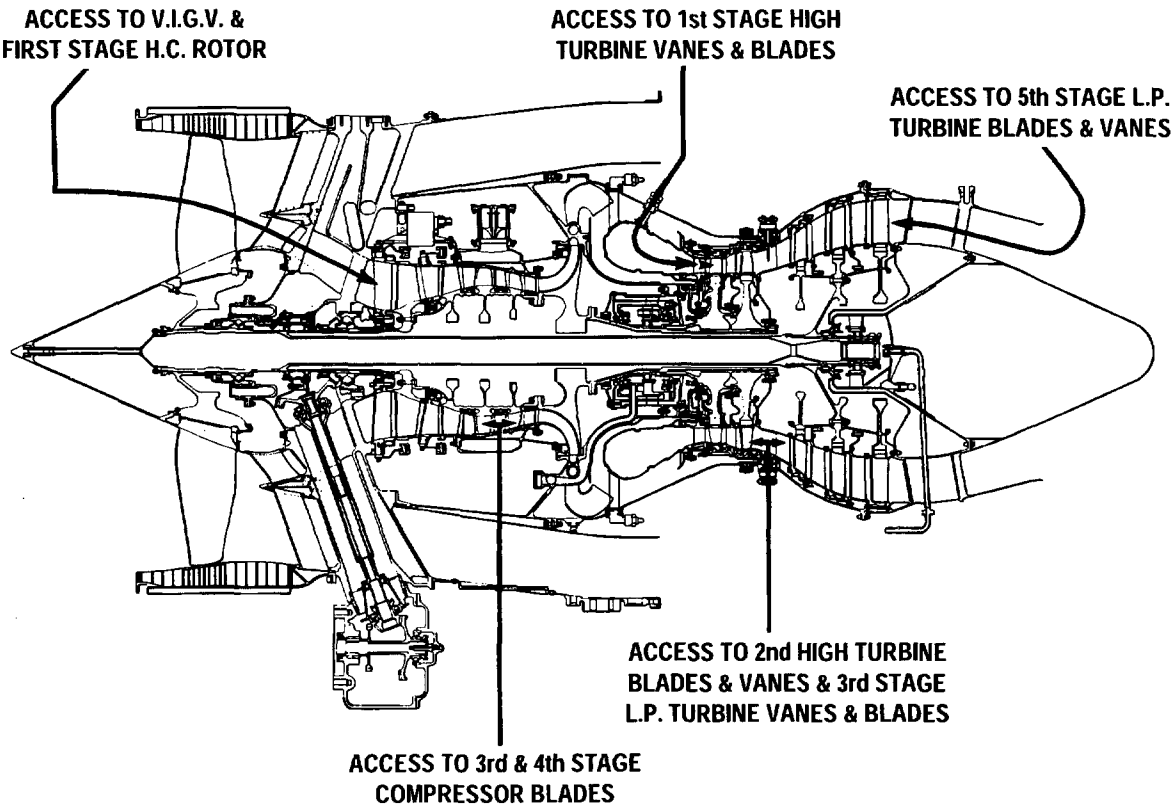
A. Inspection (Ref. Fig. 602 and Table 603)

NOTE: Refer also to Borescope Inspection (Ref. Para. 11.) and first-stage HP Compressor Blade Inspection (Ref. Para. 13.).

(1) Remove accessory gearbox breather tube (Ref. Airframe Maintenance Manual).

(2) Insert borescope probe through fan and core stators until VIGV is visible.

(3) Inspect VIGV.


ACCESS TO V.I.G.V. &
FIRST STAGE H.C. ROTOR
ACCESS TO 1st STAGE HIGH
TURBINE VANES & BLADES
ACCESS TO 5th STAGE L.P.
TURBINE BLADES & VANES
ACCESS TO 2nd HIGH TURBINE
BLADES & VANES & 3rd STAGE
L.P. TURBINE VANES & BLADES
ACCESS TO 3rd & 4th STAGE
COMPRESSOR BLADES

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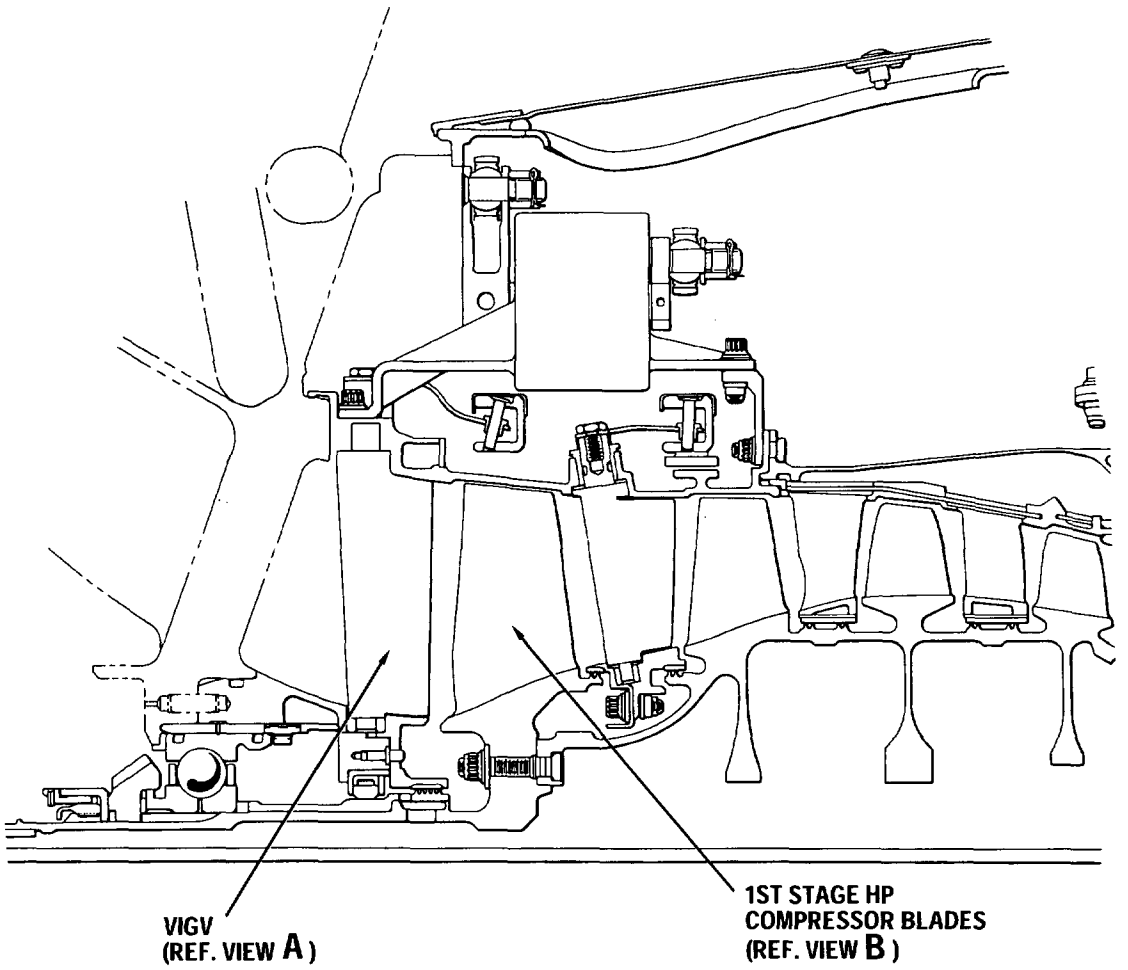
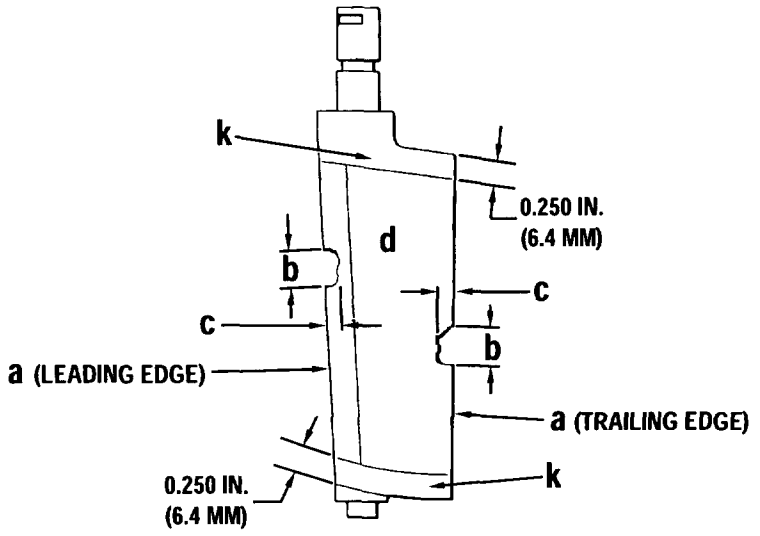
Borescope Access Ports
Figure 601

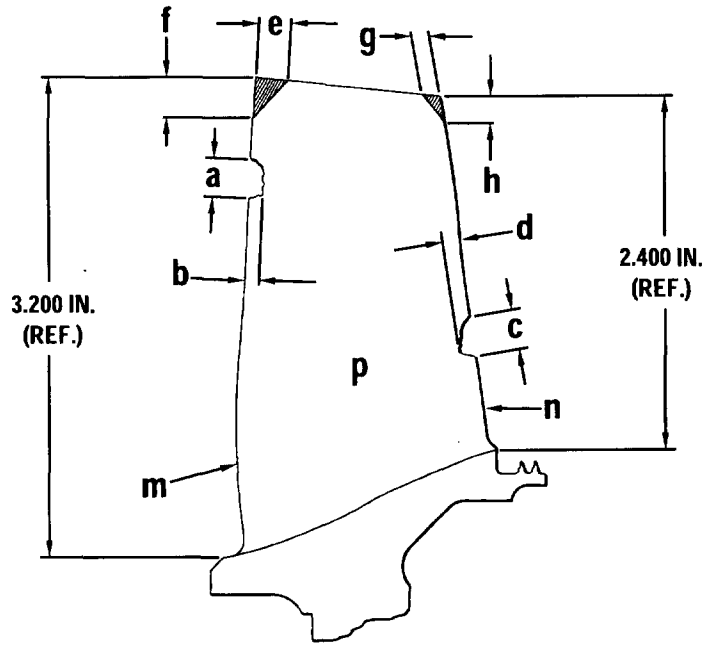


C19122

VIGV and First-stage HP Compressor Blades
Figure 602 (Sheet 1 of 2)



VIEW A (VIGV)



VIEW B (1ST STAGE BLADE)

C19123

VIGV and First-stage HP Compressor Blades
Figure 602 (Sheet 2)

(4) Reposition probe (Ref. Step (2) and (3)) until all 29 vanes have been inspected.

(5) Remove borescope.

(6) Reinstall AGB breather tube (Ref. Airframe Maintenance Manual).

TABLE 603, VIGV Inspection

Inspection Criteria	Acceptable Limits - Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Engine Overhaul (See NOTE)
Cracks or Tears	None permitted	N/A	Any cracks or tears.
Nicks: Leading and Trailing edge (Areas a)	Maximum of two per vane permitted if:	Maximum of two per vane permitted on a maximum of four vanes if:	More than two nicks per vane or more than four vanes damaged.
	- Dim. b is less than 0.150 inch (3.8 mm).	- Dim. b is less than 0.200 inch (5.1 mm).	Dim. b is more than 0.200 inch (5.1 mm).
	- Dim. c is less than 0.050 inch (1.3 mm).	- Dim. c is less than 0.070 inch (1.8 mm).	Dim. c is more than 0.070 inch (1.8 mm).
	- Nicks are separated by a minimum of 0.200 inch (5.1 mm) and are not within 0.250 inch (6.4 mm) of vane root or tip.	- Nicks are separated by a minimum of 0.200 inch (5.1 mm) and are not within 0.250 inch (6.4 mm) of vane root or tip.	Nicks occur within 0.250 inch (6.4 mm) of vane root or tip.
	Damage Limits (see NOTE) - Maximum three nicks per vane to a maximum of six vanes if: - Dim. b is less than 0.300 inch (7.6 mm). - Dim. c is less than 0.100 inch (2.5 mm). - Nicks within 0.250 inch (6.4 mm) of vane root or tip are acceptable to a maximum depth of 0.010 inch (0.25 mm).	N/A	
Surface Damage: Nicks or Dents (Areas k)	No damage permitted.	N/A	Any evidence of nicks or dents.

TABLE 603, VIGV Inspection (Cont'd)

Inspection Criteria	Acceptable Limits - Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Engine Overhaul (See NOTE)
Nicks or Dents (Area d)	No damage permitted.	Permitted to a maximum depth of 0.010 inch (0.25 mm) if damage is not directly opposite on pressure and suction sides of vane.	Damage more than 0.010 inch (0.25 mm) deep or occurring directly opposite on pressure and suction sides of vane.
	Damage Limits (see NOTE) - Damage to a maximum depth of 0.015 inch if nicks or dents are not closely grouped.		

NOTE: If damage is more than limits specified, remove engine and do an overhaul. If an aircraft must be flown to a facility equipped for engine removal, record the extent of damage and submit this information to Pratt & Whitney Canada. A review of the information may permit P&WC to recommend limited engine operation for purposes of obtaining a flight permission from the operator's regulatory authority.

13. First-stage HP Compressor Blade

A. Inspection (Ref. Fig. 602 and Table 604)

NOTE: Refer also to Borescope Inspection (Ref. Para. 11.) and VIGV Inspection (Ref. Para. 12.).

(1) Remove accessory gearbox breather tube (Ref. Airframe Maintenance Manual).

(2) Insert borescope probe through fan and core stators. (Ref. Fig. 602).

(3) Feed probe through VIGV until First-stage HP compressor blade is visible.

(4) Inspect compressor blade.

NOTE: Make sure the Trailing Edge of the blade is inspected for cracks.

CAUTION: ENSURE TIP OF BORESCOPE IS NOT ENGAGED BETWEEN COMPRESSOR BLADES BEFORE ROTATING ENGINE.

(5) Rotate engine slowly (using a 1/2 inch square drive wrench inserted through AGB breather outlet) and repeat until all 23 blades have been inspected.

(6) Remove borescope.

(7) Reinstall AGB breather tube (Ref. Airframe Maintenance Manual).

TABLE 604, First-Stage HP Compressor Blade Inspection

Inspection criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Engine Overhaul (See NOTE)
Cracks or Tears	None permitted	N/A	Any visible cracks or tears.
Nicks: Leading edge (Area m)	Maximum of two per blade if:	Maximum of two per blade permitted on a maximum of four blades if:	More than two nicks per blade or more than four blades damaged.
	- Dim. a is less than 0.125 inch (3.2 mm).	- Dim. a is less than 0.250 inch (6.4 mm).	Dim. a is more than 0.250 inch (6.4 mm).
	- Dim. b is less than 0.050 inch (1.3 mm).	- Dim. b is less than 0.100 inch (2.5 mm).	Dim. b is more than 0.100 inch (2.5 mm).
	- Nicks are separated by a minimum of 0.200 inch (5.1 mm) and are not within 0.250 inch (6.4 mm) of blade root or 0.300 inch (7.6 mm) of blade tip.	- Nicks are separated by a minimum of 0.200 inch (5.1 mm) and are not within 0.250 inch (6.4 mm) of blade root or 0.300 inch (7.6 mm) of blade tip.	Nicks are within 0.250 inch (6.4 mm) of blade root or 0.300 inch (7.6 mm) of blade tip.
	Damage Limits (see NOTE): Maximum of three nicks per blade on a maximum of six blades if: - Dim. a is less than 0.300 inch (7 .6 mm). - Dim. b is less than 0.125 inch (3.2 mm). - Nicks within 0.250 inch (6.4 mm) of blade root are permitted to a maximum depth of 0.005 inch (0.13 mm).		
Nicks: Trailing edge (Area n)	Maximum of two per blade permitted if:	Maximum of two per blade permitted on a maximum of four blades if:	More than two nicks per blade or more than four blades damaged.
	- Dim. c is less than 0.070 inch (1.8 mm).	- Dim. c is less than 0.150 inch (3.8 mm).	Dim. c is more than 0.150 inch (3.8 mm).
	- Dim. d is less than 0.020 inch (0.5 mm).	- Dim. d is less than 0.040 inch (1.0 mm).	Dim. d is more than 0.040 inch (1.0 mm).

TABLE 604, First-Stage HP Compressor Blade Inspection (Cont'd)

Inspection criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Engine Overhaul (See NOTE)
	- nicks are separated by a minimum of 0.200 inch (5.1 mm) and are not within 0.250 inch (6.4 mm) of blade root.	- nicks are separated by a minimum of 0.200 inch (5.1 mm) and are not within 0.250 inch (6.4 mm) of blade root.	Nicks are within 0.250 inch (6.4 mm) of blade root.
	Damage Limits (see NOTE): Maximum of three nicks per blade on a maximum of six blades if: - Dim. c is less than 0.210 inch (5.3 mm). - Dim. d is less than 0.060 inch (1.5 mm). - Nicks within 0.250 inch (6.4 mm) of blade root are permitted to a maximum depth of 0.005 inch (0.13 mm).		
Surface Damage: Nicks or Dents (Area p)	No damage permitted.	Permitted to a maximum depth of 0.010 inch (0.025 mm) if damage is not directly opposite on pressure and suction sides of blade.	Damage more than 0.010 inch (0.25 mm) deep or is directly opposite on pressure and suction sides of blade.
	Damage Limits (see NOTE): Damage to a maximum depth of 0.015 inch if nicks or dents are not closely grouped.		
Blade Tip Corner Loss: Leading edge	Permitted if:	Permitted if:	
	- Dim. e is less than 0.100 inch (2.5 mm).	- Dim. e is less than 0.200 inch (5.0 mm).	Dim. e is more than 0.200 inch (5.0 mm).
	- Dim. f is less than 0.200 inch (5.0 mm).	- Dim. f is less than 0.400 inch (10.1 mm).	Dim. f is more than 0.400 inch (10.1 mm).
	Damage Limits (see NOTE): - Dim. e is less than 0.250 inch (6.3 mm). - Dim. f is less than 0.500 inch (12.7 mm).		

TABLE 604, First-Stage HP Compressor Blade Inspection (Cont'd)

Inspection criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Engine Overhaul (See NOTE)
Blade Tip Corner Loss: Trailing edge	Permitted if:	Permitted if:	
	- Dim. g is less than 0.030 inch (0.7 mm).	- Dim. g is less than 0.060 inch (1.5 mm).	Dim. g more than 0.060 inch (1.5 mm).
	- Dim. h is less than 0.030 inch (0.7 mm).	- Dim. h is less than 0.060 inch (1.5 mm).	Dim. h more than 0.060 inch (1.5 mm).
	Damage Limits (see NOTE): - Dim. g and Dim. h less than 0.080 inch (2.0 mm).		

NOTE: If damage is more than limits specified, record the extent of damage and submit this information to Pratt & Whitney Canada. A review of the information may permit P&WC to perform a repair or make a recommendation for limited engine operation to fly to a facility for engine removal. Flight permission from the operator's regulatory authority is required.

14. Fourth-stage HP Compressor Blade

A. Inspection (Ref. Fig. 603 and Table 605)

NOTE: Refer to Borescope Inspection (Ref. Para. 11.).

(1) If necessary, remove accessory gearbox breather tube (Ref. Airframe Maintenance Manual).

(2) Remove six bolts (1) fastening cover (2) at blanked off LP bleed port. Remove cover (2) and gasket (3), discard gasket.

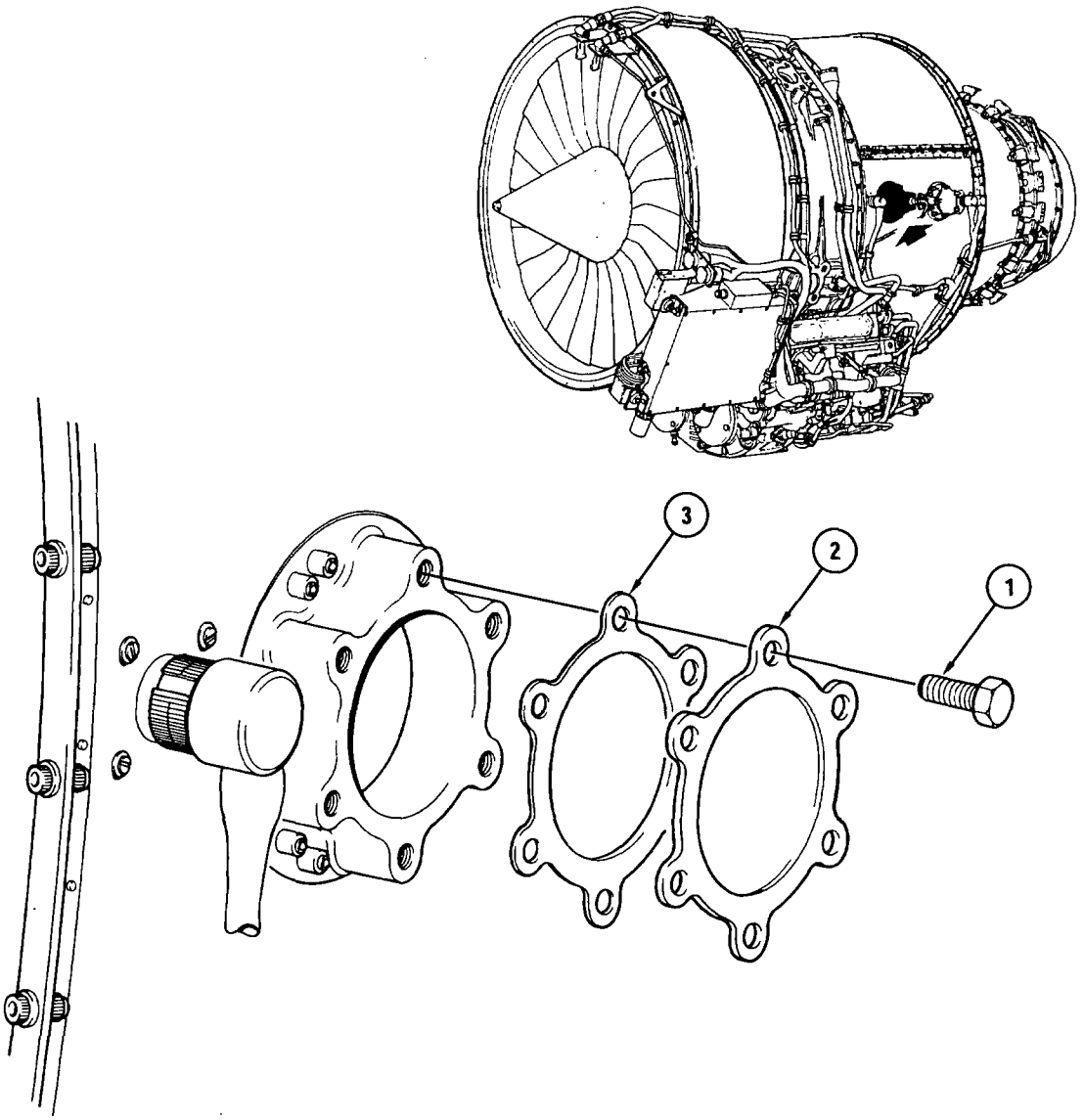
(3) Install guide tube (PWC43671) with two bolts (1).

(4) Feed borescope probe through guide tube and into third-stage HP compressor vane area.

(5) Position probe such that fourth-stage HP compressor blade can be viewed.

NOTE: It is possible to view blade leading edge only.

(6) Inspect fourth-stage compressor blade.



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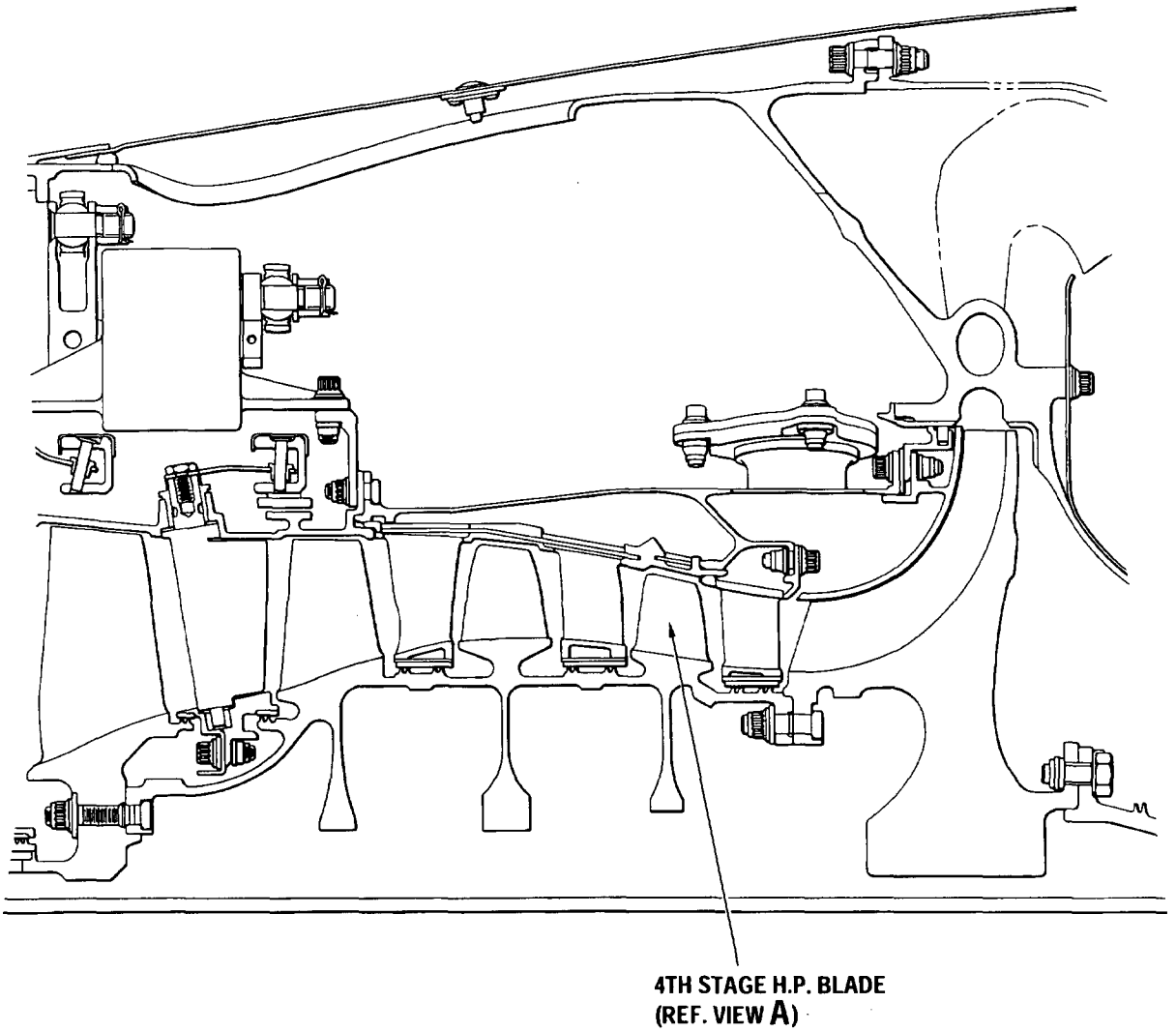
Fourth-stage HP Compressor Blades
Figure 603 (Sheet 1 of 3)

Key to Figure 603

1. Bolt
2. Cover
3. Gasket



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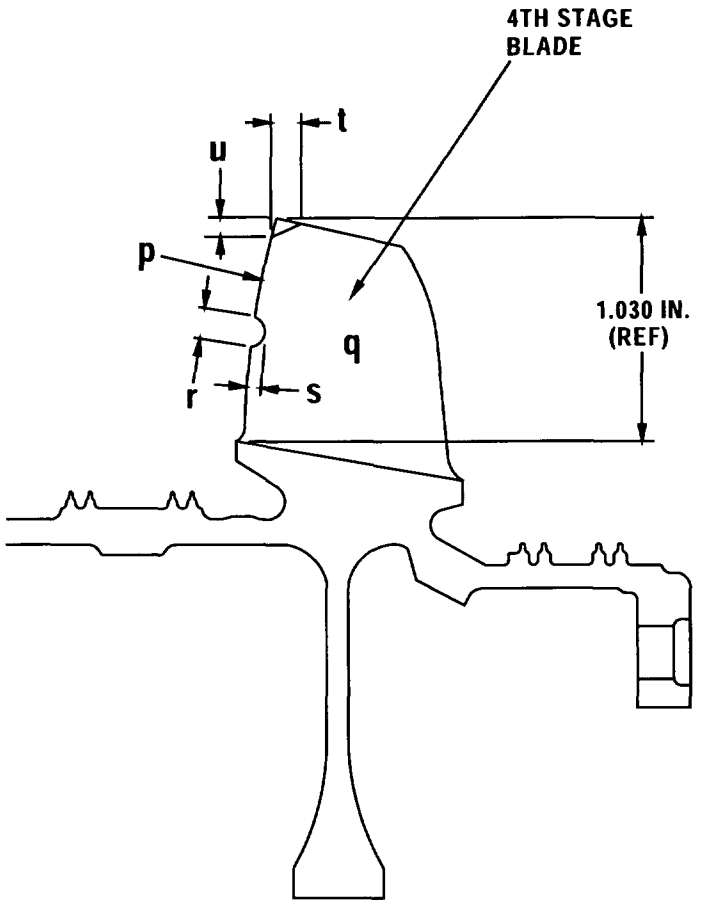
Fourth-stage HP Compressor Blades
Figure 603 (Sheet 2)



VIEW A

C19126A

Fourth-stage HP Compressor Blades
Figure 603 (Sheet 3)

CAUTION: MAKE SURE TIP OF BORESCOPE IS NOT ENGAGED BETWEEN COMPRESSOR BLADES BEFORE ROTATING ENGINE.

(7) Rotate engine slowly (using a ½ inch square drive wrench inserted through accessory gearbox breather outlet) and repeat until all 39 blades have been inspected.

(8) Remove borescope and guide tube.

(9) Install cover (2) with new gasket (3) on LP bleed port, secure cover using six bolts (1). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(10) Reinstall AGB breather tube (Ref. Airframe Maintenance Manual).

TABLE 605, Fourth-stage HP Compressor Blade Inspection

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Do Engine Overhaul (See Note)
Cracks or Tears	None permitted	N/A	Any cracks or tears.
Nicks: Leading edge (Area p)	Maximum two nicks per blade if:	Maximum two nicks per blade on a maximum of four blades if:	More than two nicks per blade or more than four blades damaged.
	- Dim. r is less than 0.060 inch (1.5 mm).	- Dim. r is less than 0.125 inch (3.2 mm).	Dim. r is more than 0.125 inch (3.2 mm).
	- Dim. s is less than 0.040 inch (1.0 mm).	- Dim. s is less than 0.080 inch (2.0 mm).	Dim. s is more than 0.080 inch (2.0 mm).
	- Nicks are separated by a minimum of 0.200 inch (5.1 mm) and are not within 0.250 inch (6.4 mm) of blade root or 0.125 inch (3.2 mm) of blade tip.	- Nicks are separated by a minimum of 0.200 inch (5.1 mm) and are not within 0.250 inch (6.4 mm) of blade root or 0.125 inch (3.2 mm) of blade tip.	Nicks are closer than 0.250 inch (6.4 mm) from blade root or 0.125 inch (3.2 mm) of blade tip.

TABLE 605, Fourth-stage HP Compressor Blade Inspection (Cont'd)

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Do Engine Overhaul (See Note)
	Damage Limits (see NOTE): Maximum of three nicks per blade on a maximum of seven blades if: - Dim r is less than 0.180 inch (4.6 mm). - Dim. s is less than 0.120 inch (3.0 mm). - Nicks closer than 0.250 inch (6.4 mm) to blade root are permitted to a maximum depth of 0.003 inch (0.07 mm).		
Surface Damage: Nicks or Dents (Area q)	No damage permitted.	Permitted to a maximum depth of 0.010 inch (0.25 mm) if damage is not directly opposite on pressure and suction sides of blade.	Damage more than 0.010 inch (0.25 mm) deep or is directly opposite on pressure and suction sides of blade.
	Damage Limits (see NOTE) - Damage to a maximum depth of 0.015 inch if nicks or dents are not closely grouped.		
Blade Tip Corner Loss: Leading edge	Dim. t is less than 0.050 inch (1.3 mm).	Dim. t is less than 0.100 inch (2.5 mm).	Dim. t is more than 0.100 inch (2.5 mm).
	Dim. u is less than 0.050 inch (1.3 mm).	Dim. u is less than 0.100 inch (2.5 mm).	Dim. u is more than 0.100 inch (2.5 mm).
	Damage Limits (see NOTE) Dim. t and Dim. u are less than 0.150 inch (3.8 mm).		

NOTE: If damage is more than limits specified, remove engine and do an overhaul. If an aircraft must be flown to a facility equipped for engine removal, record the extent of damage and submit this information to Pratt & Whitney Canada. A review of the information may permit P&WC to recommend limited engine operation for purposes of obtaining flight permission from the operator's regulatory authority.

15. Fuel Nozzles

A. Inspection (Ref. Fig. 604)

NOTE: 1. Refer to Borescope Inspection (Ref. Para. 11.).

NOTE: 2. The combustion chamber liner can be inspected at this time.

(1) If necessary, remove accessory gearbox breather tube (Ref. Aircraft Maintenance Manual).

(2) Gain access to igniter plugs (Ref. Aircraft Maintenance Manual).

WARNING: VOLTAGE OUTPUT OF IGNITION EXCITER IS SUFFICIENT TO CAUSE A LETHAL ELECTRICAL SHOCK. RESIDUAL VOLTAGE IN IGNITION EXCITER MAY BE DANGEROUSLY HIGH. ENSURE IGNITION IS SWITCHED OFF. DISCONNECT INPUT CONNECTOR FIRST (REF. AIRFRAME MAINTENANCE MANUAL) AND ALLOW AT LEAST SIX MINUTES TO ELAPSE BEFORE FURTHER WORK IS ATTEMPTED. DISCONNECT IGNITER CABLES AT EXCITER BEFORE DISCONNECTING AT IGNITER PLUGS. ALWAYS USE INSULATED TOOLS TO REMOVE CABLE COUPLING NUTS. DO NOT TOUCH OUTPUT CONNECTORS OR COUPLING NUTS WITH BARE HANDS.

CAUTION: DO NOT LET IGNITION CABLE BRAIDING OR FERRULES ROTATE WHEN TURNING COUPLING NUTS.

(3) Disconnect ignition exciter input connector (Ref. Aircraft Maintenance Manual).

NOTE: It is necessary to remove only one igniter plug for borescope access.

(4) Loosen coupling nuts and disconnect ignition cable (1) from ignition exciter (2) and igniter plug (3).

(5) Remove igniter plug (3) and gasket (4).

(6) Examine igniter plug for damage (Ref. 74-10-01).

(7) Feed borescope probe through igniter boss into combustion chamber liner. Manipulate probe until fuel nozzle is visible.

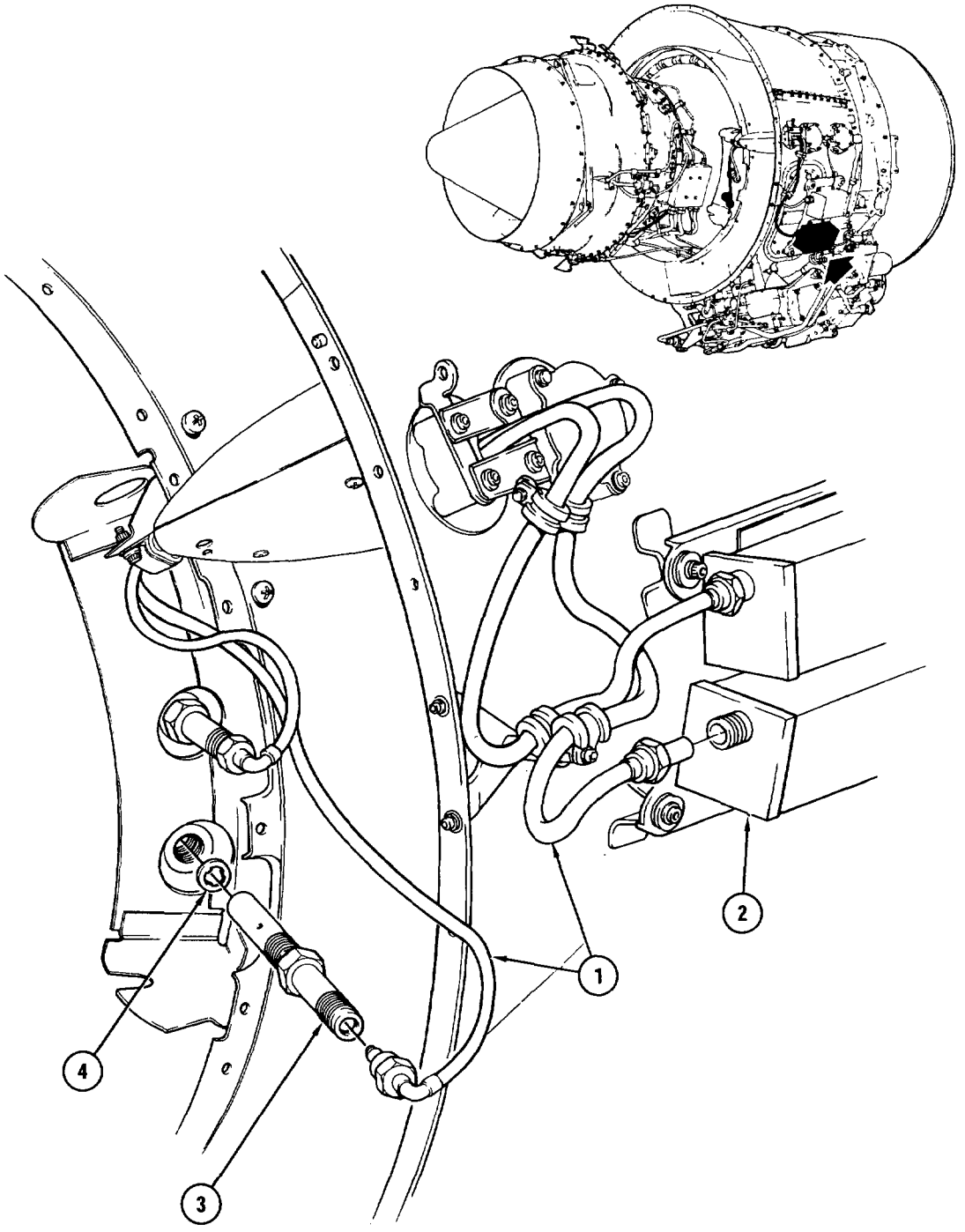
(8) Inspect fuel nozzle for evidence of:

(a) Carbon build-up affecting fuel nozzle operation.

(b) Nozzle blockage.

(c) Thermal distress.

(9) If any of above conditions are evident, inspect all downstream areas for damage. If no downstream damage is evident, engine may continue in service with a reduced borescope frequency of 50 operating hours.



C19127

Igniter Plug Removal
Figure 604

Key to Figure 604

1. Ignition Cable
2. Ignition Exciter
3. Igniter Plug
4. Gasket

(10) Repeat procedure until all 24 fuel nozzles have been inspected.

NOTE: Fuel nozzles are line replacable (Ref. 73-10-04).

16. Combustion Chamber Liner

A. Inspection (Ref. Fig. 604, 605 and Table 606)

NOTE: 1. Pre-SB24349 and Pre-SB24365 combustion chamber liners require scheduled borescope inspection. Refer to Chapter 05-20-00, Periodic Inspection.

NOTE: 2. Post-SB24365 combustion chamber liners do not require scheduled borescope inspection.

NOTE: 3. For engines operating on-condition Hot Section Inspection using ECTM, combustion chamber liners require scheduled borescope inspection. Refer to Chapter 05-20-00, Periodic Inspection.

(1) If necessary, remove accessory gearbox breather tube (Ref. Aircraft Maintenance Manual).

(2) Gain access to igniter plugs (Ref. Aircraft Maintenance Manual).

WARNING: VOLTAGE OUTPUT OF IGNITION EXCITER IS SUFFICIENT TO CAUSE A LETHAL ELECTRICAL SHOCK. RESIDUAL VOLTAGE IN IGNITION EXCITER MAY BE DANGEROUSLY HIGH. ENSURE IGNITION IS SWITCHED OFF. DISCONNECT INPUT CONNECTOR FIRST (REF. AIRFRAME MAINTENANCE MANUAL) AND ALLOW AT LEAST SIX MINUTES TO ELAPSE BEFORE FURTHER WORK IS ATTEMPTED. DISCONNECT IGNITER CABLES AT EXCITER BEFORE DISCONNECTING AT IGNITER PLUGS. ALWAYS USE INSULATED TOOLS TO REMOVE CABLE COUPLING NUTS. DO NOT TOUCH OUTPUT CONNECTORS OR COUPLING NUTS WITH BARE HANDS.

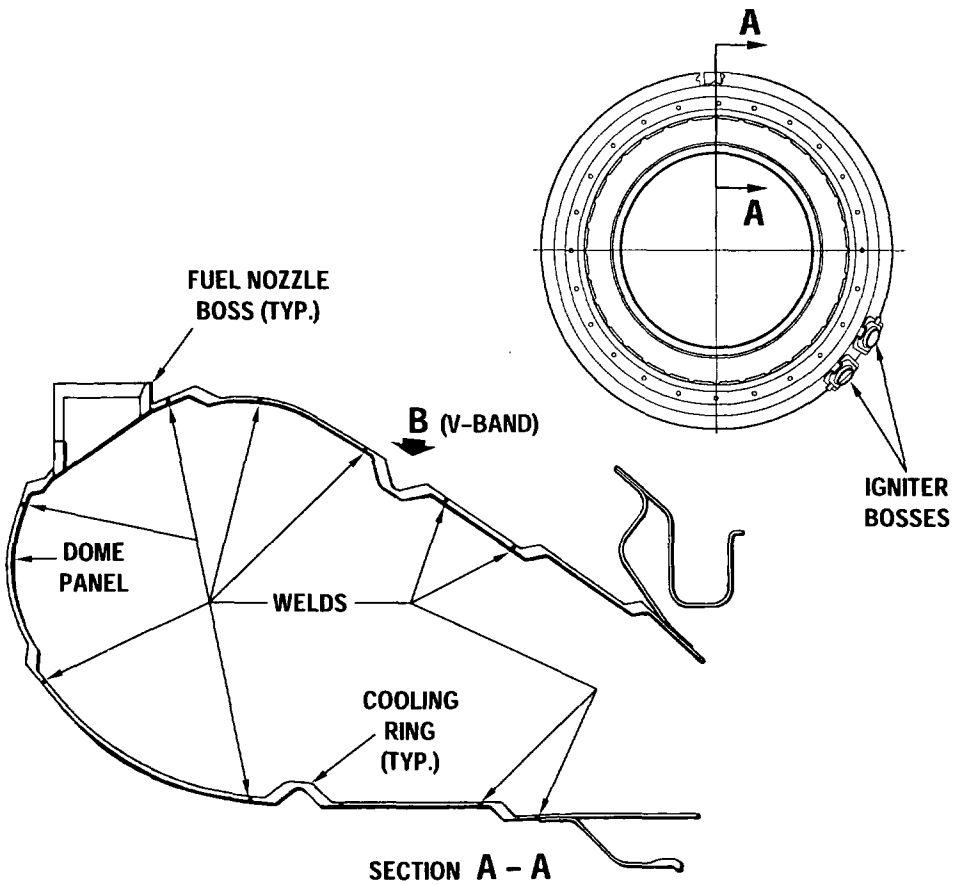
CAUTION: DO NOT ALLOW IGNITION CABLE BRAIDING OR FERRULES TO ROTATE WHEN TURNING COUPLING NUTS.

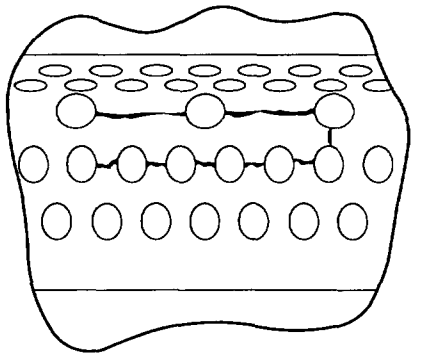
(3) Disconnect ignition exciter input connector (Ref. Aircraft Maintenance Manual).

NOTE: It is necessary to remove only one igniter plug for borescope access.

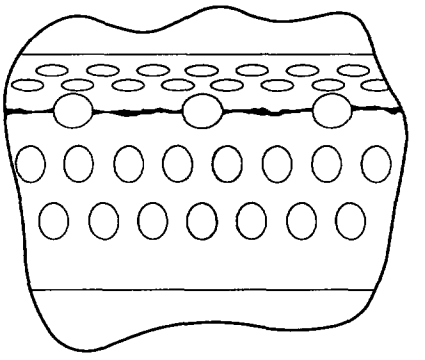
(4) Loosen coupling nuts and disconnect ignition cable (1, Fig. 604) from ignition exciter (2) and igniter plug (3).

(5) Remove igniter plug (3) and gasket (4).





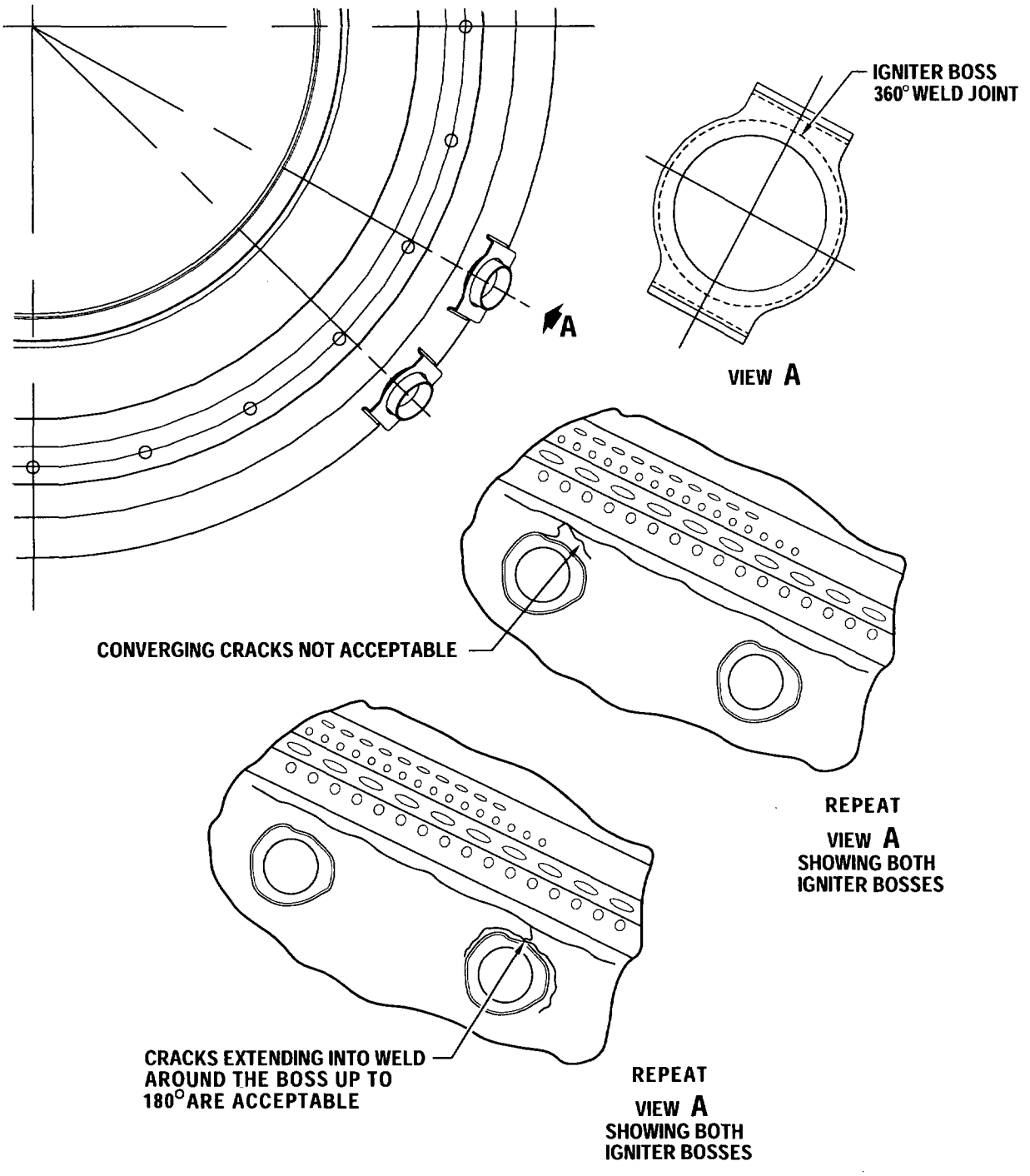
VIEW B
UNACCEPTABLE CRACKS.
CONVERGING CRACKS WITH
POTENTIAL FOR MATERIAL LOSS
ARE NOT ACCEPTABLE.



VIEW B
ACCEPTABLE CRACKS.
SINGLE OR MULTIPLE CRACKS
THRU UP TO 6 INCHES LONG
(APPROX. 30 HOLES) IN V-BAND
AREA ARE ACCEPTABLE.

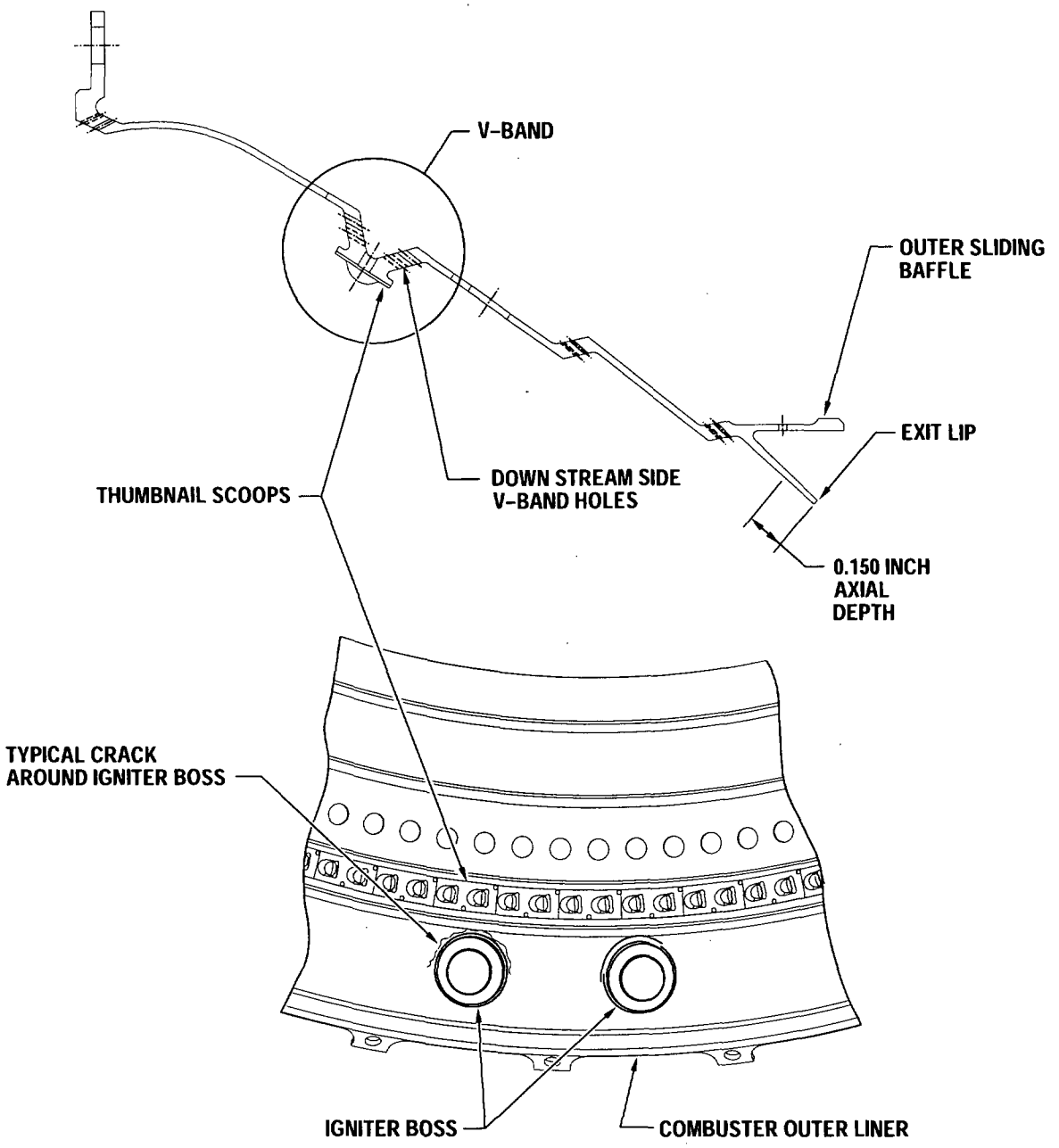
Pre-SB24365 C19128B

Combustion Chamber Liner Borescope Inspection
Figure 605 (Sheet 1 of 5)



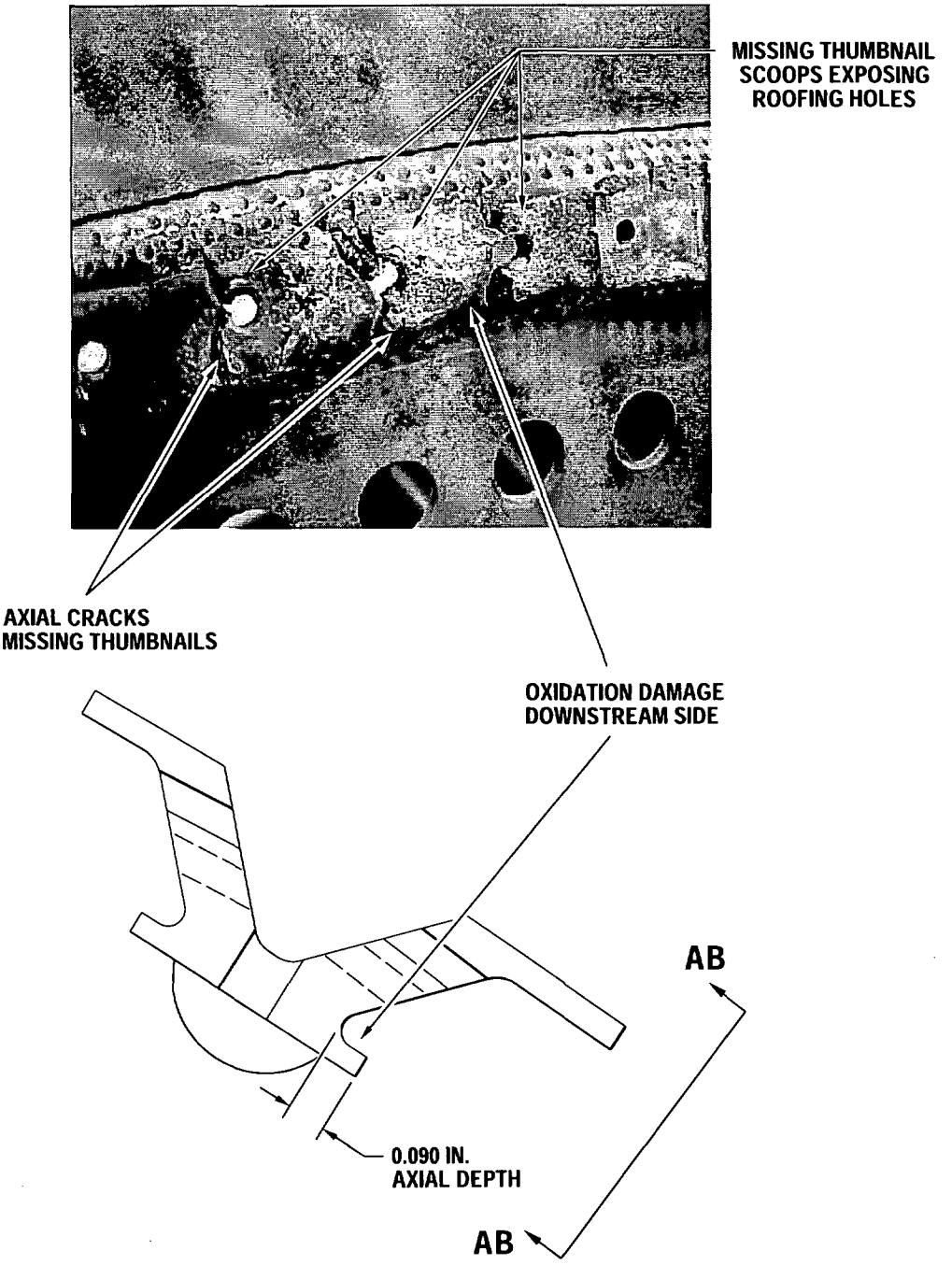
Pre-SB24365 C34537D

Combustion Chamber Liner Borescope Inspection
Figure 605 (Sheet 2)



Post-SB24490 C92987

Combustion Chamber Liner Borescope Inspection
Figure 605 (Sheet 3)

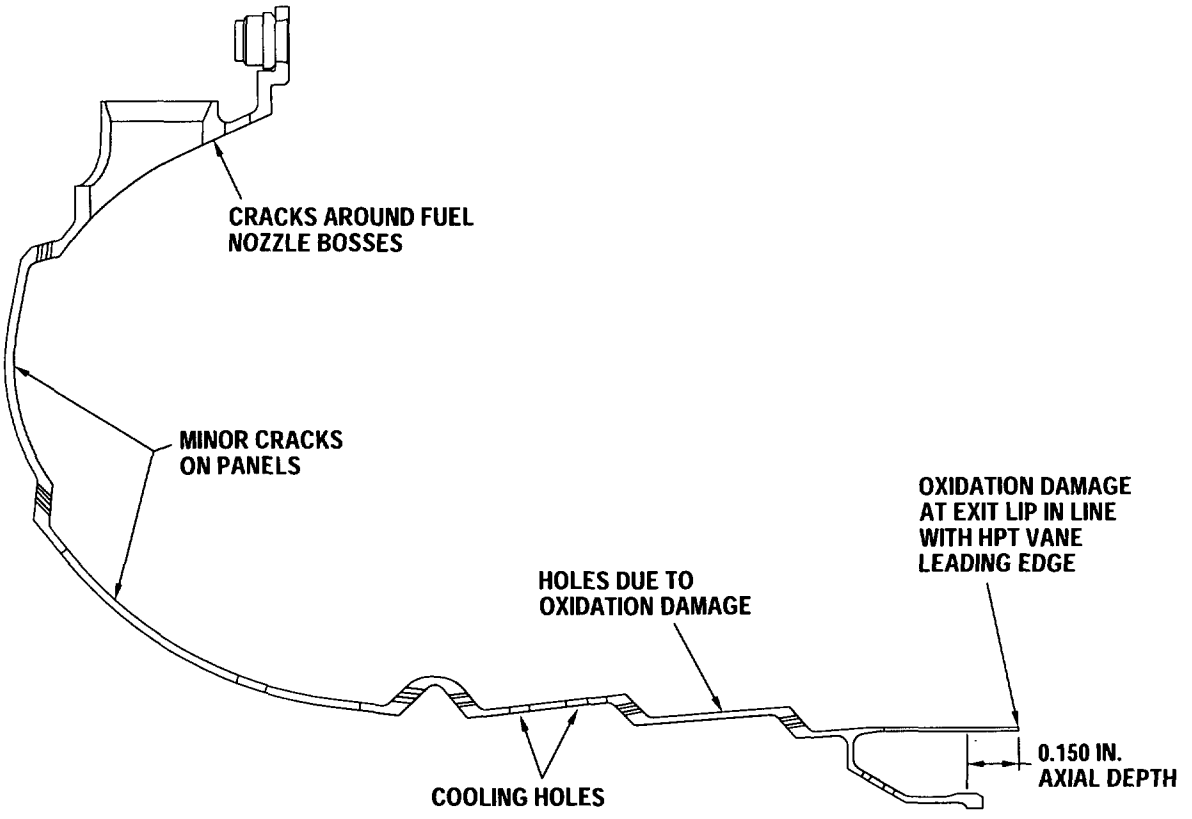


ORIGINAL
As Received By
ATP

Post-SB24490

C98587

Combustion Chamber Liner Borescope Inspection
Figure 605 (Sheet 4)


CRACKS AROUND FUEL NOZZLE BOSSES
MINOR CRACKS ON PANELS
OXIDATION DAMAGE AT EXIT LIP IN LINE WITH HPT VANE LEADING EDGE
HOLES DUE TO OXIDATION DAMAGE
0.150 IN. AXIAL DEPTH
COOLING HOLES
COMBUSTOR INNER LINER

Post-SB24490 C98588

Combustion Chamber Liner Borescope Inspection
Figure 605 (Sheet 5)

(6) Examine igniter plug for damage (Ref. 74-10-01).

(7) For Pre-SB24365 liners, inspect the igniter plug boss at the four and five o'clock positions as follows:

(a) Install short guide tube from kit (PWC60877) in igniter plug boss at the four o'clock position.

(b) Install the borescope tip into the guide tube and protrude 0.600 to 0.750 inch.

(c) The borescope is now between the combustion chamber outer case and the combustion chamber liner.

(d) Turn borescope tip 90° towards igniter boss at the five o'clock position for inspection.

(e) Move the borescope tip forward 1.500 inch toward the igniter boss.

(f) Rotate the borescope tip around the igniter boss seam weld area and inspect for cracks.

(g) Rotate borescope tip upstream toward the machine cooling hole area and inspect the seam weld and cooling holes for cracks.

(h) Remove borescope and install long guide tube from kit (PWC60877) in igniter plug boss at the four o'clock position.

(i) Install the borescope tip into the guide tube.

(j) The borescope is now inside the combustion chamber liner.

(k) Turn borescope tip 90° towards igniter boss at the five o'clock position for inspection.

(l) Move the borescope tip forward 1.500 inch toward the igniter boss.

(m) Rotate the borescope tip around the igniter boss seam weld area and inspect for cracks.

(n) Rotate borescope tip upstream toward the machine cooling hole area and inspect the seam weld and cooling holes for cracks.

(o) If distress is found, refer to Table 606 for acceptance criteria.

(8) Inspect the combustion liner other areas as follows:

(a) Using borescope guide tube (PWC43685), insert the borescope through the igniter plug opening and inspect different areas of the combustion liner.

NOTE: 1. If available, use a 5 mm borescope, as this is more rigid and allows the operator to manoeuvre it inside the combustion liner.

NOTE: 2. The guide tube insertion arrow must be pointing towards the front, top of the engine at an angle of between 45 and 90 degrees.

(9) If distress is found, refer to Table 606 for acceptance criteria.

TABLE 606, Combustion Chamber Liner Borescope Inspection

Inspection Criteria	Acceptable Limits - Continue in Service
OUTER LINER Post-SB24490 **OUTER LINER PANEL Pre-SB24490**	
FUEL NOZZLE BOSSES	
Cracks	Width of each crack is not more than 0.030 inch. Extension of any crack can extend up to 180° around fuel nozzle boss.
IGNITER BOSSES	
Cracks	Width of each crack is not more than 0.060 inch. Extension of any crack can extend up to 180° around igniter bosses.
SEAM WELDS	
Cracks immediately downstream of ignition bosses	Width of each crack is not more than 0.060 inch. Length of each crack is not more than 6.00 inches.
PLASMA COATING LOSS	
	Acceptable. May be associated with multi-pronged cracks and shallow buckling.
Oxidation and Material Loss	Post-SB24490: Outer liner exit lip in line with HPT vane airfoils, provided damge is less than 0.150 inch axial depth and 0.350 inch circumferential width.
V-BAND Pre-SB24444	
Cracks between cooling holes	Any number of axial cracks combined with circumferential cracks, provided the cracks do not form a closing pattern, with potential for material loss. Total length of circumferential cracks up to 6.00 inches (approximately 30 holes).

TABLE 606, Combustion Chamber Liner Borescope Inspection (Cont'd)

Inspection Criteria	Acceptable Limits - Continue in Service
V-BAND AND THUMBNAIL SCOOPS Post-SB24444	
Oxidation Damage	Total loss of up to 50% thumbnail scoops (60 scoops), exposing the V-band holes. Minor oxidation erosion on the remaining thumbnail scoops exposing 50% of the V-band hole. Maximum of four V-band lips with erosion on the downstream side, not exceeding 0.090 inch axial depth and 3.00 inches circumferential direction.
Cracks	Any number of axial cracks on the V-band, provided the cracks are not converging such that a piece of metal may come loose. Cracks must not propagate circumferentially. Non-converging cracks joining not more than five holes in the V-band, provided they are not close to each other such that a piece of metal may come loose.
OUTER BAFFLE Pre-SB24490 (Non-gas path area)	
Cracks	Circumferential cracks up to a total length of 18 inches are acceptable. NOTE: This area is not borescoped normally. It may be borescoped for troubleshooting purposes.
INNER LINER PANEL Pre-SB24490 INNER LINER Post-SB24490	
Oxidation and Material Loss	Maximum of five holes due to oxidation damage, provided they do not exceed 0.225 inch in diameter. NOTE: For reference purposes, the larger of the two rows of cooling holes located on the inner panel is 0.225 inch in diameter. Inner liner exit lip, in line with all the HPT vane airfoil, provided the damage is within 0.150 inch axial depth and 0.350 inch circumferential width.
PLASMA COATING LOSS	
	Acceptable. It may be associated with multi-pronged cracks and shallow buckling.

TABLE 606, Combustion Chamber Liner Borescope Inspection (Cont'd)

Inspection Criteria	Acceptable Limits - Continue in Service
SEAM WELDS	
Cracks	Cracks up to 6.00 inches long and 0.030 inch width are acceptable.
V-BAND	
Cracks between cooling holes	Any number of axial cracks combined with circumferential cracks, provided the cracks do not form a closing pattern, with potential for material loss. Length of circumferential crack up to 6.00 inches (approximately 30 holes).
NOTE: If damage is more than limits specified, replace liner within 25 hours. If an aircraft must be flown to a facility equipped for combustor removal, record the extent of damage and submit this information to Pratt & Whitney Canada. A review of the information may permit P&WC to recommend limited engine operation for the purpose of obtaining flight permission from the operator's regulatory authority.	

17. First-stage HP Turbine Vane

A. Inspection (Ref. Fig. 606 and Table 607)

NOTE: *Refer to Borescope Inspection* (Ref. Para. 11.).

(1) If necessary, remove accessory gearbox breather tube (Ref. Aircraft Maintenance Manual).

(2) Gain access to igniter plugs (Ref. Aircraft Maintenance Manual).

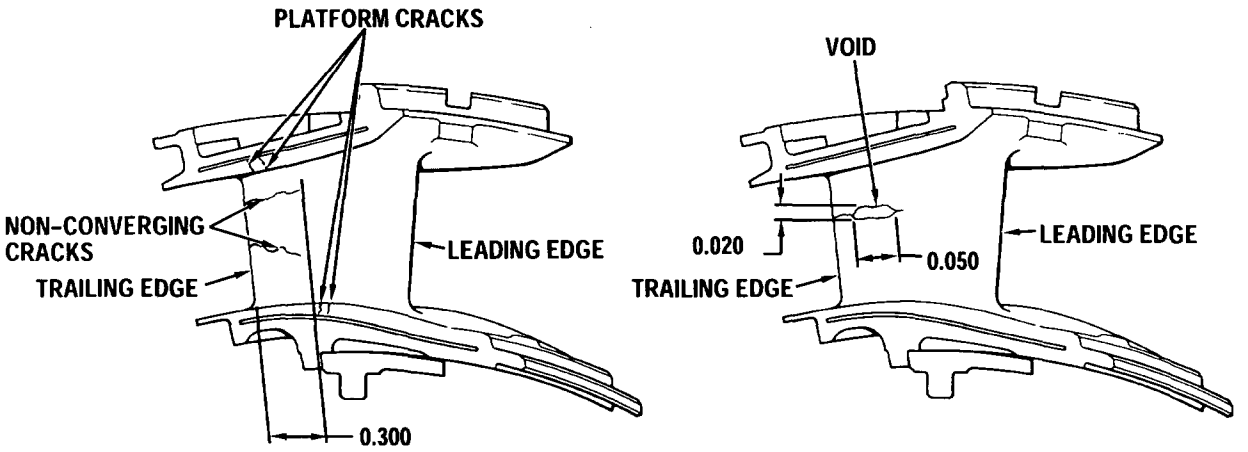
WARNING: VOLTAGE OUTPUT OF IGNITION EXCITER IS SUFFICIENT TO CAUSE A LETHAL ELECTRICAL SHOCK. RESIDUAL VOLTAGE IN IGNITION EXCITER MAY BE DANGEROUSLY HIGH. ENSURE IGNITION IS SWITCHED OFF. DISCONNECT INPUT CONNECTOR FIRST (REF. AIRFRAME MAINTENANCE MANUAL) AND ALLOW AT LEAST SIX MINUTES TO ELAPSE BEFORE FURTHER WORK IS ATTEMPTED. DISCONNECT IGNITER CABLES AT EXCITER BEFORE DISCONNECTING AT IGNITER PLUGS. ALWAYS USE INSULATED TOOLS TO REMOVE CABLE COUPLING NUTS. DO NOT TOUCH OUTPUT CONNECTORS OR COUPLING NUTS WITH BARE HANDS.

CAUTION: DO NOT ALLOW IGNITION CABLE BRAIDING OR FERRULES TO ROTATE WHEN TURNING COUPLING NUTS.

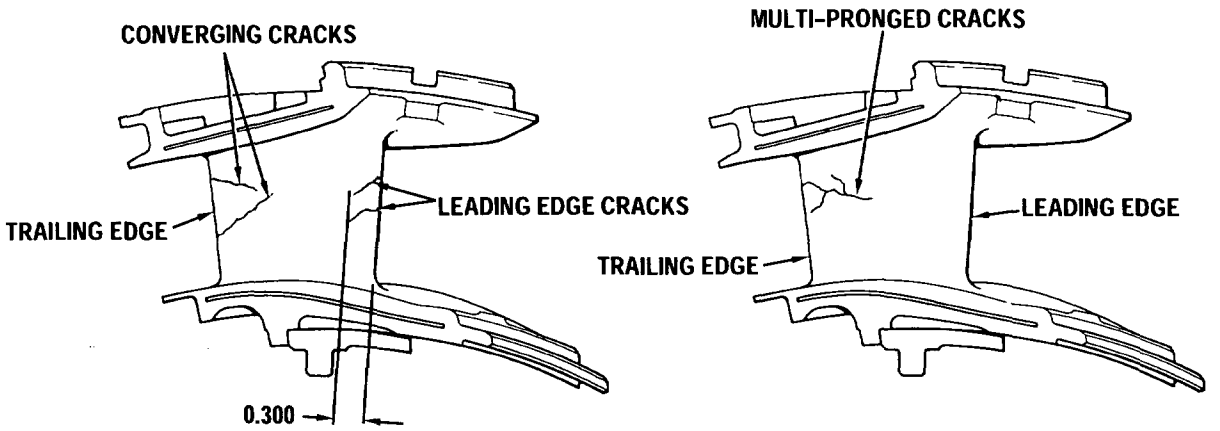
(3) Disconnect ignition exciter input connector (Ref. Aircraft Maintenance Manual).

NOTE: It is necessary to remove only one igniter plug for borescope access.

(4) Loosen coupling nuts and disconnect ignition cable (1, Fig. 604) from ignition exciter (2) and igniter plug (3).



ACCEPTABLE VANE SEGMENT CRACKS



UNACCEPTABLE VANE SEGMENT CRACKS

C19129

First-stage HP Turbine Vane Inspection
Figure 606

(5) Remove igniter plug (3) and gasket (4).

(6) Examine igniter plug for damage (Ref. 74-10-01).

(7) Install guide tube (PWC43685) in either igniter plug boss.

(8) Feed borescope through guide tube until first-stage HP turbine vane segment can be viewed.

(9) Inspect first-stage vane segment (Ref. Table 607).

(10) Rotate guide tube and inspect as many vane segments as possible.

(11) Remove borescope and guide tube.

TABLE 607, First-stage HP Turbine Vane Inspection

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Cracks:			
Leading Edge:	No cracks permitted within 0.3 inch (7.6 mm) of leading edge. Perform HSR if any cracks evident.	N/A	No cracks permitted within 0.3 inch (7.6 mm) of leading edge.
Trailing Edge:	Converging cracks are permitted if:	Converging cracks are permitted if:	Converging cracks longer than 0.300 inch (7.6 mm).
	- Length of each crack is less than 0.150 inch (3.8 mm).	- Length of each crack is less than 0.250 inch (6.4 mm).	Multi-pronged cracks when total crack length is more than 0.300 inch (7.6 mm).
	- Each crack is separated by a minimum of 0.250 inch (6.4 mm) at converging ends.	- Each crack is separated by a minimum of 0.200 inch (5.0 mm) at converging ends.	
Remainder of Vane	Total of three cracks permitted if:	Total of five cracks permitted if:	More than five cracks.
	- Length of each crack is less than 0.150 inch (3.8 mm).	- Length of each crack is less than 0.200 inch (5.0 mm).	Length of any crack is more than 0.3 inch (7.6 mm).
	- Each crack is more than 0.3 inch (7.6 mm) from leading edge.	- Each crack is more than 0.3 inch (7.6 mm) from leading edge.	Cracks extend into leading edge.
Surface Damage:			

TABLE 607, First-stage HP Turbine Vane Inspection (Cont'd)

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Nicks or Dents	Permitted to a maximum depth of 0.010 inch (0.25 mm).	N/A	Damage more than 0.010 inch (0.25 mm) deep.
Coating Loss:	Minor coating loss permitted to a maximum area of 0.5 x 0.5 inch (12.7 x 12.7 mm) if diffusion layer remains intact.	Minor coating loss permitted (including diffusion layer) to a maximum area of 0.5 x 0.5 inch (12.7 x 12.7 mm) if there is no deterioration of parent material.	Loss of coating more than an area of 0.5 x 0.5 inch (12.7 x 12.7) or deterioration of parent material.
Trailing Edge Cut-back Holes:			
Blockage	Blocked holes less than 40 percent span are acceptable.	N/A	Blockage of more than two consecutive holes above 40 percent span.

NOTE: If damage is more than limits specified, remove engine and do an overhaul. If an aircraft must be flown to a facility equipped for engine removal, record the extent of damage and submit this information to Pratt & Whitney Canada. A review of the information may permit P&WC to recommend limited engine operation for purposes of obtaining flight permission from the operator's regulatory authority.

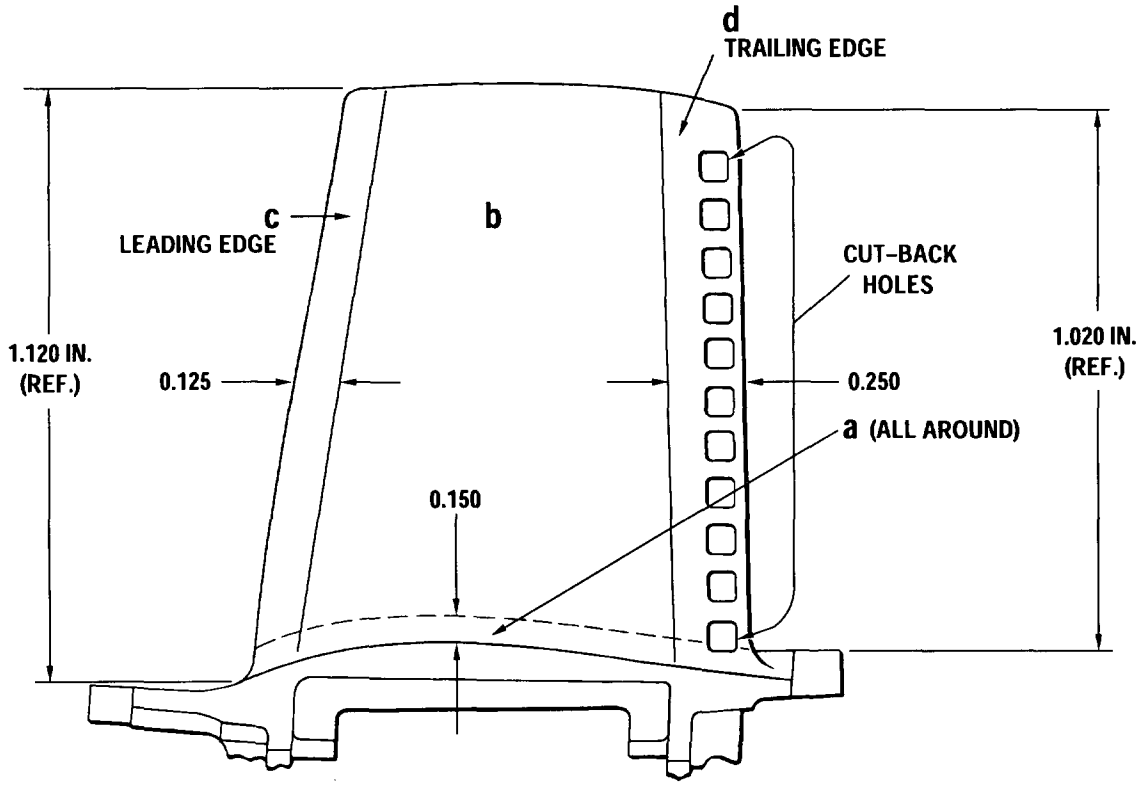
18. First-stage HP Turbine Blade

A. Inspection (Ref. Fig. 607 and Table 608)

NOTE: Refer to Borescope Inspection (Ref. Para. 11.).

(1) If necessary, remove accessory gearbox breather tube (Ref. Aircraft Maintenance Manual).

(2) Gain access to igniter plugs (Ref. Aircraft Maintenance Manual).



C19130A

First-stage HP Turbine Blade Inspection
Figure 607

WARNING: VOLTAGE OUTPUT OF IGNITION EXCITER IS SUFFICIENT TO CAUSE A LETHAL ELECTRICAL SHOCK. RESIDUAL VOLTAGE IN IGNITION EXCITER MAY BE DANGEROUSLY HIGH. ENSURE IGNITION IS SWITCHED OFF. DISCONNECT INPUT CONNECTOR FIRST (REF. AIRFRAME MAINTENANCE MANUAL) AND ALLOW AT LEAST SIX MINUTES TO ELAPSE BEFORE FURTHER WORK IS ATTEMPTED. DISCONNECT IGNITER CABLES AT EXCITER BEFORE DISCONNECTING AT IGNITER PLUGS. ALWAYS USE INSULATED TOOLS TO REMOVE CABLE COUPLING NUTS. DO NOT TOUCH OUTPUT CONNECTORS OR COUPLING NUTS WITH BARE HANDS.

CAUTION: DO NOT ALLOW IGNITION CABLE BRAIDING OR FERRULES TO ROTATE WHEN TURNING COUPLING NUTS.

(3) Disconnect ignition exciter input connector (Ref. Aircraft Maintenance Manual).

NOTE: It is necessary to remove only one igniter plug for borescope access.

(4) Loosen coupling nuts and disconnect ignition cable (1, Fig. 604) from ignition exciter (2) and igniter plug (3).

(5) Remove igniter plug (3) and gasket (4).

(6) Examine igniter plug for damage (Ref. 74-10-01).

(7) Install guide tube (PWC43685) in either igniter plug boss.

(8) Feed borescope through vane until first-stage HP turbine blade can be viewed.

(9) Inspect first-stage HP turbine blade (Ref. Table 608).

CAUTION: MAKE SURE TIP OF BORESCOPE IS NOT ENGAGED BETWEEN TURBINE BLADES BEFORE ROTATING ENGINE.

(10) Rotate engine slowly, using a ½ inch square drive wrench inserted through accessory gearbox breather outlet, and repeat until all 39 blades have been inspected.

(11) Remove borescope and guide tube.

TABLE 608, First-stage HP Turbine Blade Inspection

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Cracks:	No cracks permitted.	N/A	Any visible cracks.

TABLE 608, First-stage HP Turbine Blade Inspection (Cont'd)

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Surface Damage:			
Nicks or Dents in Area a (root fillet Rad)	No damage permitted	N/A	Any visible damage.
Nicks or dents in Area b (remainder of blade)	Permitted to a maximum depth of 0.010 inch (0.25 mm).	N/A	Damage more than 0.010 inch (0.25 mm) deep.
Pitting in Area b (remainder of blade)	Permitted to a maximum depth of 0.010 inch (0.25 mm) provided it is not more than 30 percent of total surface.	N/A	Damage more than 0.010 inch (0.25 mm) deep or damage is more than 30 percent of total surface.
Hairline cracks in Area c (leading edge)	Permitted to a maximum depth of 0.100 inch (2.54 mm) provided cracks are located above 50 percent of the total height of the blade measured from the bottom of the fir tree root fixing.	N/A	Damage more than 0.100 inch (2.54 mm) deep or damage is located above 50 percent of the total height of the blade measured from the bottom of the fir tree root fixing.
Pitting in Area c (leading edge)	Permitted to a maximum depth of 0.020 inch (0.508 mm) provided it is not more than 30 percent of total surface.	N/A	Damage more than 0.020 inch (0.508 mm) deep or damage is more than 30 percent of total surface.
Erosion in Area c (leading edge)	Erosion confined to the coating layer is permitted provided no base material is exposed.	N/A	Damage to coating layer with the base material exposed.
Erosion in Area c (leading edge)	Erosion exposing the base material is permitted to a maximum depth of 0.005 inch (0.127 mm).	N/A	Damage more than 0.005 inch (0.127 mm) deep.

TABLE 608, First-stage HP Turbine Blade Inspection (Cont'd)

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Nicks and dents in Area c (leading edge)	Permitted to a maximum depth of 0.020 inch (5.08 mm) provided there is not more than five and separated by a minimum of 0.100 inch (0.254 mm).	N/A	Damage more than 0.100 inch (2.54 mm) deep or more than five or separated by a minimum of 0.100 inch (0.254 mm).
Coating Loss:	No coating loss permitted.	N/A	Loss of coating evident or parent material visible.
Pitting in Area d (trailing edge)	Permitted to a maximum depth of 0.010 inch (0.25 mm) provided it is not more than 30 percent of the total surface.	N/A	Damage more than 0.100 inch (2.54 mm) deep.
Nicks or dents in Area d (trailing edge)	Permitted to a maximum depth of 0.010 inch (0.25 mm) provided there is not more than four and are separated by a minimum of 0.100 inch (2.54 mm).	N/A	Damage more than 0.010 inch (0.25 mm) deep or damage is more than four and separated by a minimum of 0.100 inch (2.54 mm).
Trailing Edge Cut-back Holes			
Blockage	Maximum of two blocked holes below 30 percent span of blade are permitted.	N/A	Any blocked hole above 30 percent span of blade

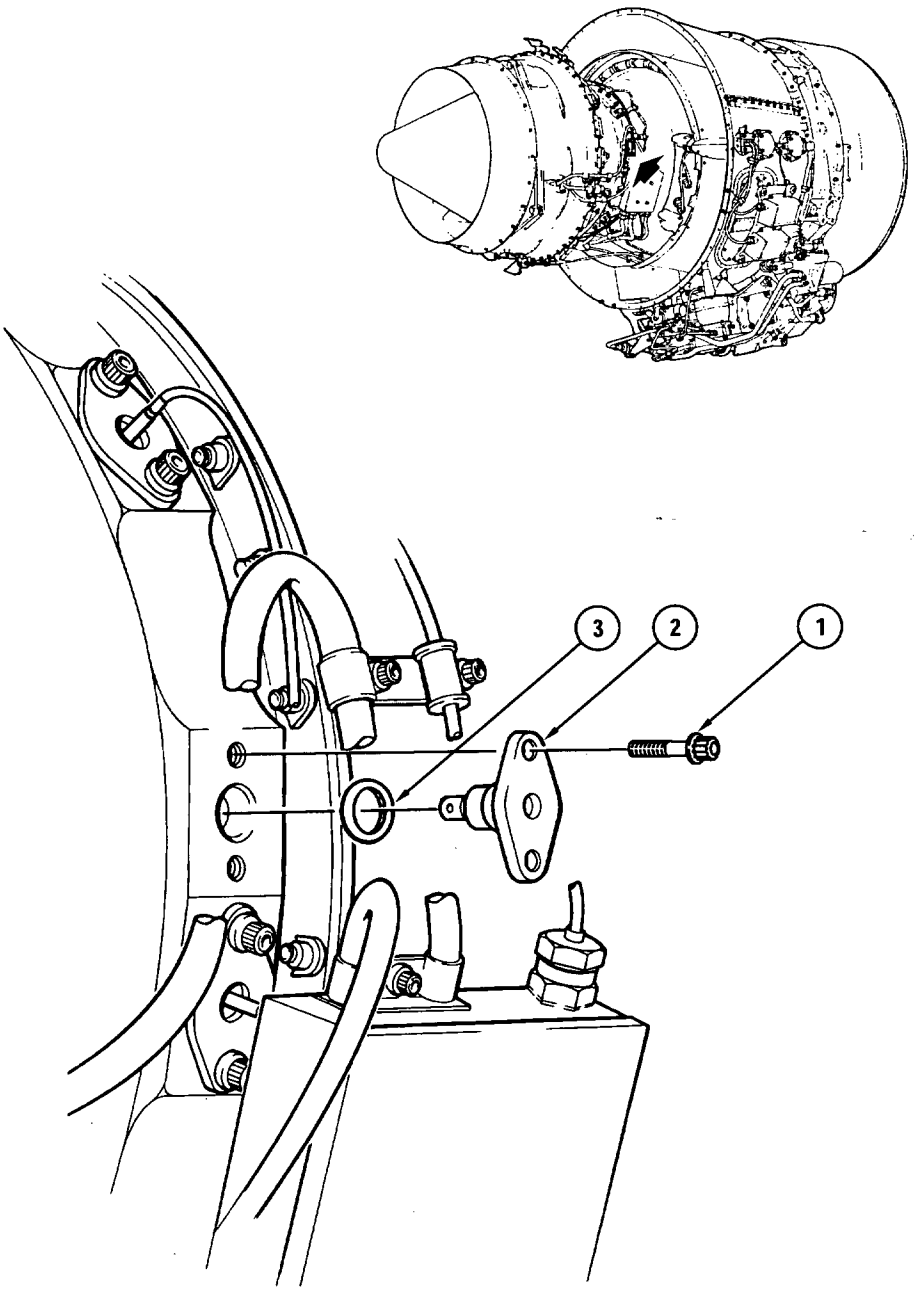
NOTE: If damage is more than limits specified, remove engine and do an overhaul. If an aircraft must be flown to a facility equipped for engine removal, record the extent of damage and submit this information to Pratt & Whitney Canada. A review of the information may permit P&WC to recommend limited engine operation for purposes of obtaining flight permission from the operator's regulatory authority.

19. Second-stage HP Turbine Blade

NOTE: This procedure includes the third-stage LP turbine vanes and third-stage LP turbine blades.

A. Inspection (Ref. Fig. 608, 609 and Table 609)

NOTE: Refer to Borescope Inspection (Ref. Para. 11.).



C19131

Borescope Blanking Plug - Removal
Figure 608

Key to Figure 608

1. Bolt
2. Blanking Plug
3. Seal Ring

(1) If necessary, remove accessory gearbox breather tube (Ref. Aircraft Maintenance Manual).

CAUTION: BEFORE REMOVING BOLTS (1), LUBRICATE THREADS FOR A MINIMUM OF 20 MINUTES WITH PENETRATING OIL (PWC05-076). **DO NOT USE WD-40**. DO NOT USE TOO MUCH FORCE TO ROTATE THE BOLTS, BACK OFF BOLTS BY A QUARTER TURN FREQUENTLY DURING REMOVAL.

(2) Remove two bolts (1, Fig. 608) and borescope blanking plug (2) from LP turbine case.

(3) Remove and discard seal ring (3).

(4) Insert borescope through access port and position probe such that second-stage HP turbine blade can be viewed.

(5) Inspect second-stage HP turbine blade (Ref. Table 609).

CAUTION: MAKE SURE TIP OF BORESCOPE IS NOT ENGAGED BETWEEN TURBINE BLADES BEFORE ROTATING ENGINE.

(6) Rotate engine slowly, with a ½ inch square drive wrench inserted through accessory gearbox breather outlet,) and repeat until all 54 blades have been inspected.

(7) Feed probe through third-stage LP turbine vane until third-stage LP turbine blade is visible.

(8) Inspect third-stage LP turbine blade (Ref. Table 611).

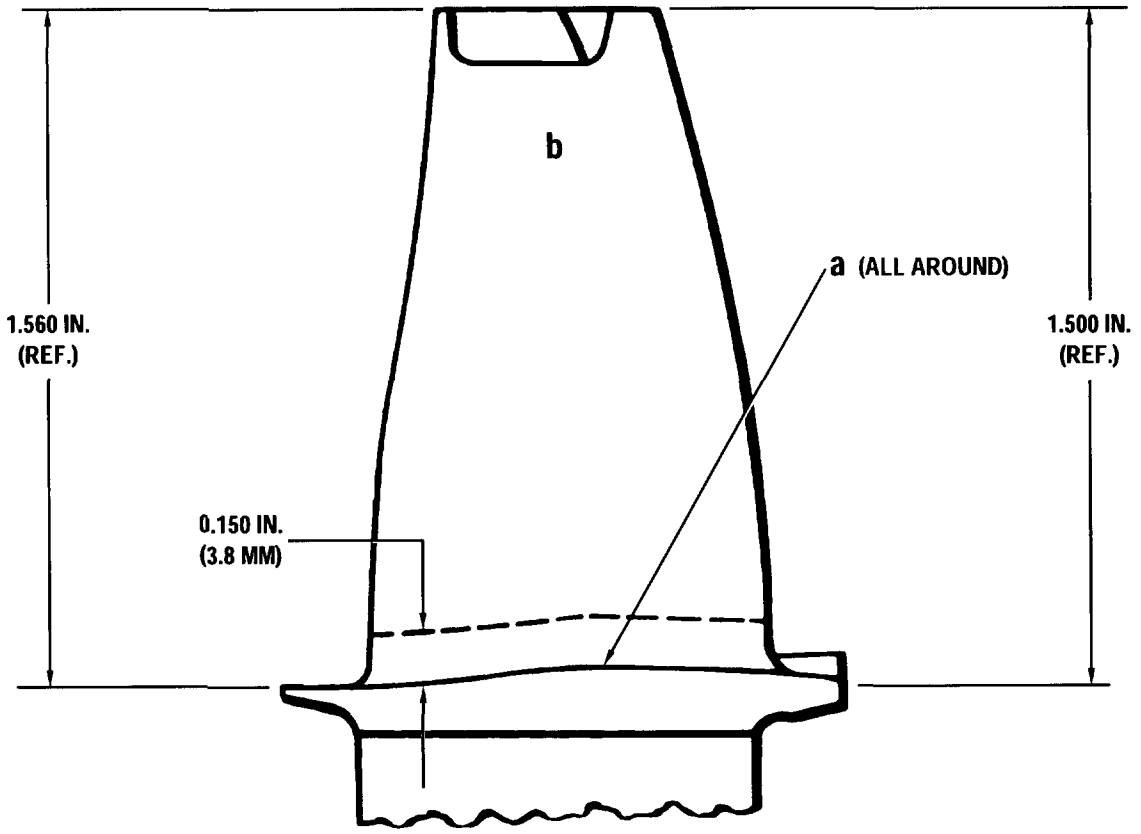
CAUTION: MAKE SURE TIP OF BORESCOPE IS NOT ENGAGED BETWEEN FIFTH-STAGE VANES BEFORE ROTATING LP SHAFT (FAN).

(9) Rotate LP shaft (fan) slowly and repeat until all 76 blades have been inspected.

(10) Install new seal ring (3) on blanking plug (2).

(11) Install blanking plug (2) in LP turbine case with bolts (1). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(12) Reinstall AGB breather tube (Ref. A.M.M.).



C19132

Second-stage HP Turbine Blade Inspection
Figure 609

TABLE 609, Second-stage HP Turbine Blade Inspection

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Cracks:	No cracks permitted.	N/A	Any visible cracks.
Surface Damage:			
Nicks or Dents in Area a (root fillet Rad)	No damage permitted.	N/A	Any visible damage.
Nicks or dents in Area b (remainder of blade)	Permitted to a maximum depth of 0.010 inch (0.25 mm).	Monitor damage to see if cracks get longer.	Damage more than 0.010 inch (0.25 mm) deep.
Coating Loss:	No coating loss permitted.	N/A	Loss of coating evident or parent material visible.

NOTE: If damage is more than limits specified, remove engine and do an overhaul. If an aircraft must be flown to a facility equipped for engine removal, record the extent of damage and submit this information to Pratt & Whitney Canada. A review of the information may permit P&WC to recommend limited engine operation for purposes of obtaining flight permission from the operator's regulatory authority.

20. Third-stage LP Turbine Vane

A. Inspection (Ref. Fig. 610 and Table 610)

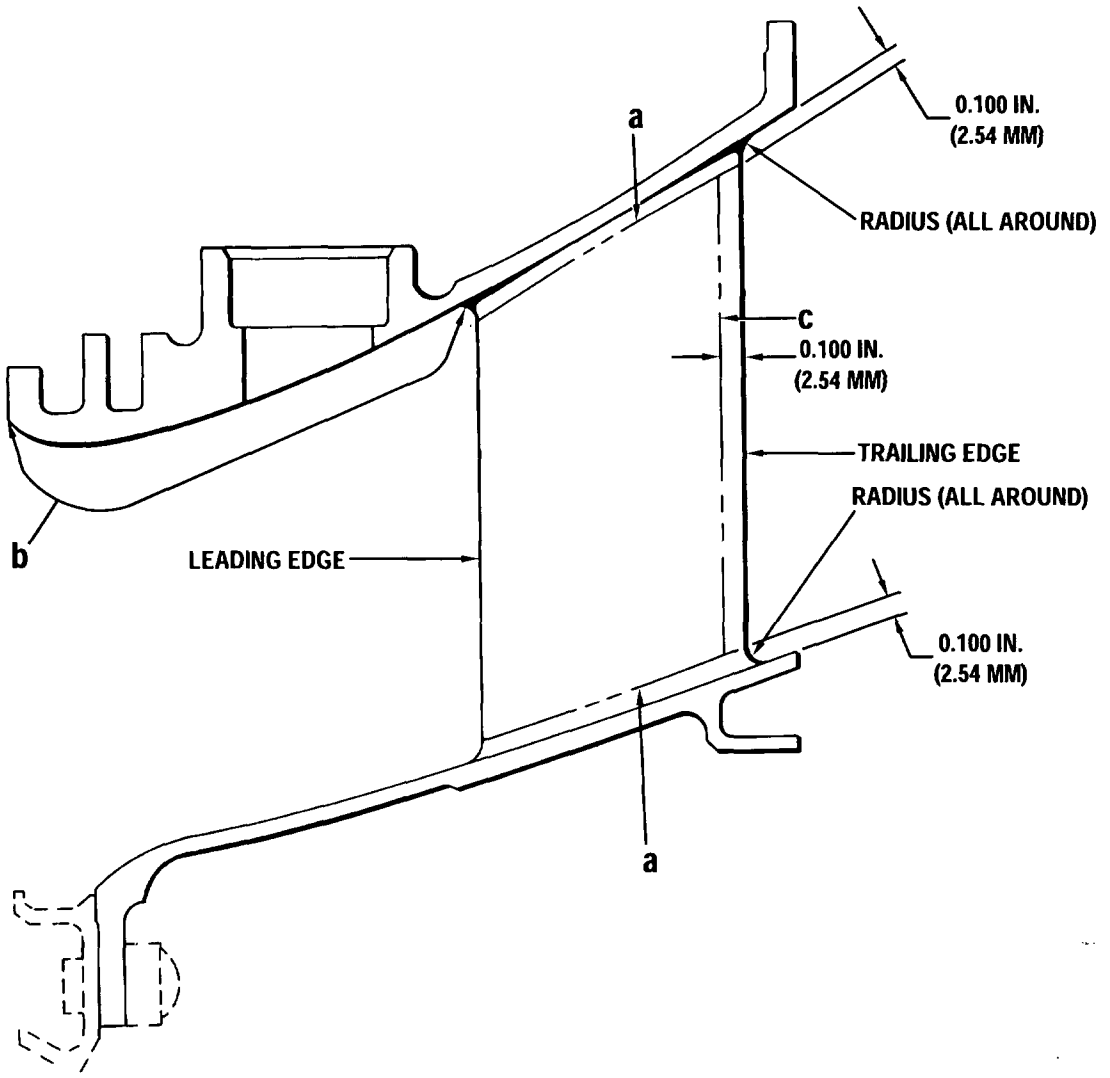
NOTE: Refer to Borescope Inspection (Ref. Para. 11.).

(1) If necessary, remove accessory gearbox breather tube (Ref. Aircraft Maintenance Manual).

CAUTION: BEFORE REMOVING BOLTS (1), LUBRICATE THREADS FOR A MINIMUM OF 20 MINUTES WITH PENETRATING OIL (PWC05-076). **DO NOT USE WD-40**. DO NOT USE TOO MUCH FORCE TO ROTATE THE BOLTS, BACK OFF BOLTS BY A QUARTER TURN FREQUENTLY DURING REMOVAL.

(2) Remove two bolts (1, Fig. 608) and borescope blanking plug (2) from LP turbine case.

(3) Remove and discard seal ring (3).



C19133

Third-stage LP Turbine Vane Inspection
Figure 610

(4) Insert borescope through access port and position probe such that third-stage LP turbine vane can be viewed.

(5) Inspect third-stage LP turbine vane.

(6) Reposition probe and repeat until all 70 vanes have been inspected.

(7) Feed probe through third-stage LP turbine vane until blade is visible.

(8) Inspect turbine blade (Ref. Table 611).

CAUTION: MAKE SURE THE TIP OF BORESCOPE IS NOT ENGAGED BETWEEN FIFTH-STAGE VANES BEFORE ROTATING LP SHAFT (FAN).

(9) Rotate LP shaft (fan) slowly and repeat until all 76 blades have been inspected.

(10) Install new seal ring (3) on blanking plug (2).

(11) Install blanking plug (2) in LP turbine case with bolts (1). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(12) Reinstall AGB breather tube (Ref. A.M.M.).

TABLE 610, Third-stage LP Turbine Vanes

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Cracks:			
Areas a (inner and outer fillet radii)	Length of each crack is less than 0.158 inch (4.0 mm).	Length of each crack is less than 0.250 inch (6.4 mm).	Length of any crack is more than 0.250 inch (6.4 mm).
Areas b (location bosses)	Length of each crack is less than 0.120 inch (3.0 mm).	Length of each crack is less than 0.250 inch (6.4 mm).	Length of any crack is more than 0.250 inch (6.4 mm).
Area c (trailing edge)	Length of each crack is less than 0.300 inch (7.6 mm).	Length of each crack is less than 0.400 inch (10.2 mm).	Length of any crack is more than 0.400 inch (10.2 mm).
	Maximum length of any crack 0.200 inch (5.0 mm). with a maximum width of 0.010 inch (0.25 mm).	Maximum length of any crack 0.300 inch (7.6 mm). with a maximum width of 0.010 inch (0.25 mm).	Any crack longer than 0.300 inch (7.6 mm) with a width more than 0.010 inch (0.25 mm).
Tears	No tears permitted.	One tear in Area c (trailing edge) permitted to a maximum length of 0.100 inch (2.5 mm).	More than one tear in Area c (trailing edge) or any tear more than 0.100 inch (2.5 mm) in length.

TABLE 610, Third-stage LP Turbine Vanes (Cont'd)

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Bends	One bend in Area c (trailing edge) to a maximum length of 25 percent of trailing edge and a maximum deflection of 0.060 inch (1.5 mm).	N/A	More than one bend in Area c (trailing edge) or bend longer than 25 percent of trailing edge or deflection of bend greater than 0.060 inch (1.5 mm).
Surface Damage:			
Nicks or dents	Maximum depth of 0.060 inch (1.5 mm).	N/A	Damage more than 0.060 inch (1.5 mm).
Coating Loss	No coating loss permitted.	Isolated minor coating loss permitted if parent material is not damaged.	Loss of coating with a deterioration of parent material.
Sulfidation (NOTE: Sulfidation appears as a green to pale blue color)	No sulfidation permitted.	Permitted over a maximum of 40 percent of vane surface if there is no material loss.	Sulfidation causing material loss.
Surface Deposits	Deposits related to normal engine running.	Normal deposits with light traces of oil or soot.	Deposits indicating heavy oil leak.

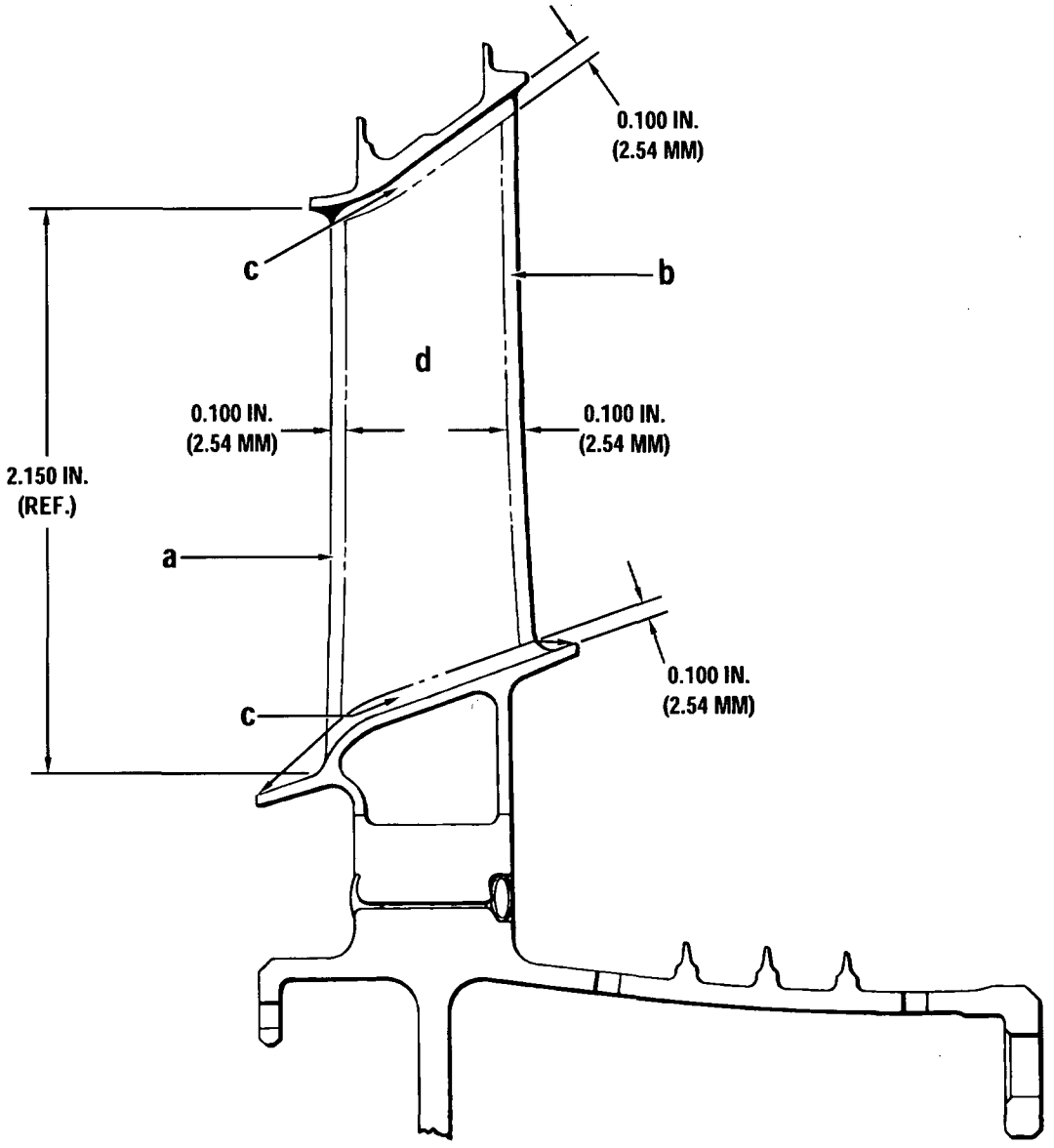
NOTE: If damage is more than limits specified, remove engine and do an overhaul. If an aircraft must be flown to a facility equipped for engine removal, record the extent of damage and submit this information to Pratt & Whitney Canada. A review of the information may permit P&WC to recommend limited engine operation for purposes of obtaining flight permission from the operator's regulatory authority.

21. Third-stage LP Turbine Blades

A. Inspection (Ref. Fig. 611 and Table 611)

NOTE: Refer to Borescope Inspection (Ref. Para. 11.).

(1) If necessary, remove accessory gearbox breather tube (Ref. Aircraft Maintenance Manual).



C19134

Third-stage LP Turbine Blades Inspection
Figure 611

CAUTION: BEFORE REMOVING BOLTS (1), LUBRICATE THREADS FOR A MINIMUM OF 20 MINUTES WITH PENETRATING OIL (PWC05-076). **DO NOT USE WD-40**. DO NOT USE TOO MUCH FORCE TO ROTATE THE BOLTS, BACK OFF BOLTS BY A QUARTER TURN FREQUENTLY DURING REMOVAL.

(2) Remove two bolts (1, Fig. 608) fastening borescope blanking plug (2) to LP turbine case.

(3) Remove blanking plug (2). Remove and discard seal ring (3).

(4) Insert borescope through access port, through third-stage LP turbine vane until third-stage LP turbine blade is visible.

CAUTION: ENSURE TIP OF BORESCOPE IS NOT ENGAGED BETWEEN TURBINE BLADES BEFORE ROTATING ENGINE.

(5) Rotate engine slowly (using a ½ inch square drive wrench inserted through accessory gearbox breather outlet) and repeat until all 54 blades have been inspected.

(6) Inspect third-stage LP turbine blade (Ref. Table 611).

CAUTION: ENSURE TIP OF BORESCOPE IS NOT ENGAGED BETWEEN FIFTH-STAGE VANES BEFORE ROTATING LP SHAFT (FAN).

(7) Rotate LP shaft (fan) slowly and repeat until all blades have been inspected.

(8) Install new seal ring (3) on blanking plug (2).

(9) Install blanking plug (2) in LP turbine case with two bolts (1). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(10) Reinstall AGB breather tube (Ref. A.M.M.).

TABLE 611, Third-stage LP Turbine Blades

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Cracks:			
Areas a and b (leading and trailing edge)	No cracks permitted.	One crack per blade maximum length of 0.050 inch (1.3 mm) if cracks occur on no more than five blades.	More than five blades cracked or any crack longer than 0.050 inch (1.3 mm).
Areas c (inner and outer fillet radii)	No cracks permitted.	N/A	Any cracks.

TABLE 611, Third-stage LP Turbine Blades (Cont'd)

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Bends	One bend permitted in Area b (trailing edge) to a maximum length of 25 percent of trailing edge and a maximum deflection of 0.015 inch (0.38 mm) to a maximum of five blades.	N/A	More than five blades damaged. More than one bend in Area b (trailing edge) or bend longer than 25 percent of trailing edge or deflection of bend greater than 0.015 inch (0.38 mm).
Tears	No tears permitted.	One tear in Area b (trailing edge) permitted to a maximum length of 0.050 inch (1.3 mm) provided tears occur on no more than five blades.	More than five blades with tears or any tear longer than 0.050 inch (1.3 mm).
Surface Damage:			
Nicks or dents (Areas a, b and d)	Permitted to a maximum depth of 0.010 inch (0.25 mm).	N/A	Damage in excess of 0.010 inch (0.25 mm).
Nicks or dents (Area c)	No damage permitted.	N/A	Damage in excess of 0.005 inch (0.13 mm).
Sulfidation (NOTE: Sulfidation appears as a green to pale blue color)	No sulfidation permitted.	Permitted over a maximum of 40 percent of vane surface if there is no material loss.	Sulfidation causing material loss.
Surface Deposits	Deposits related to normal engine running.	Normal deposits with light traces of oil or soot.	Deposits indicating heavy oil leak.

NOTE: If damage is more than limits specified, remove engine and do an overhaul. If an aircraft must be flown to a facility equipped for engine removal, record the extent of damage and submit this information to Pratt & Whitney Canada. A review of the information may permit P&WC to recommend limited engine operation for purposes of obtaining flight permission from the operator's regulatory authority.

22. Fifth-stage LP Turbine Blade

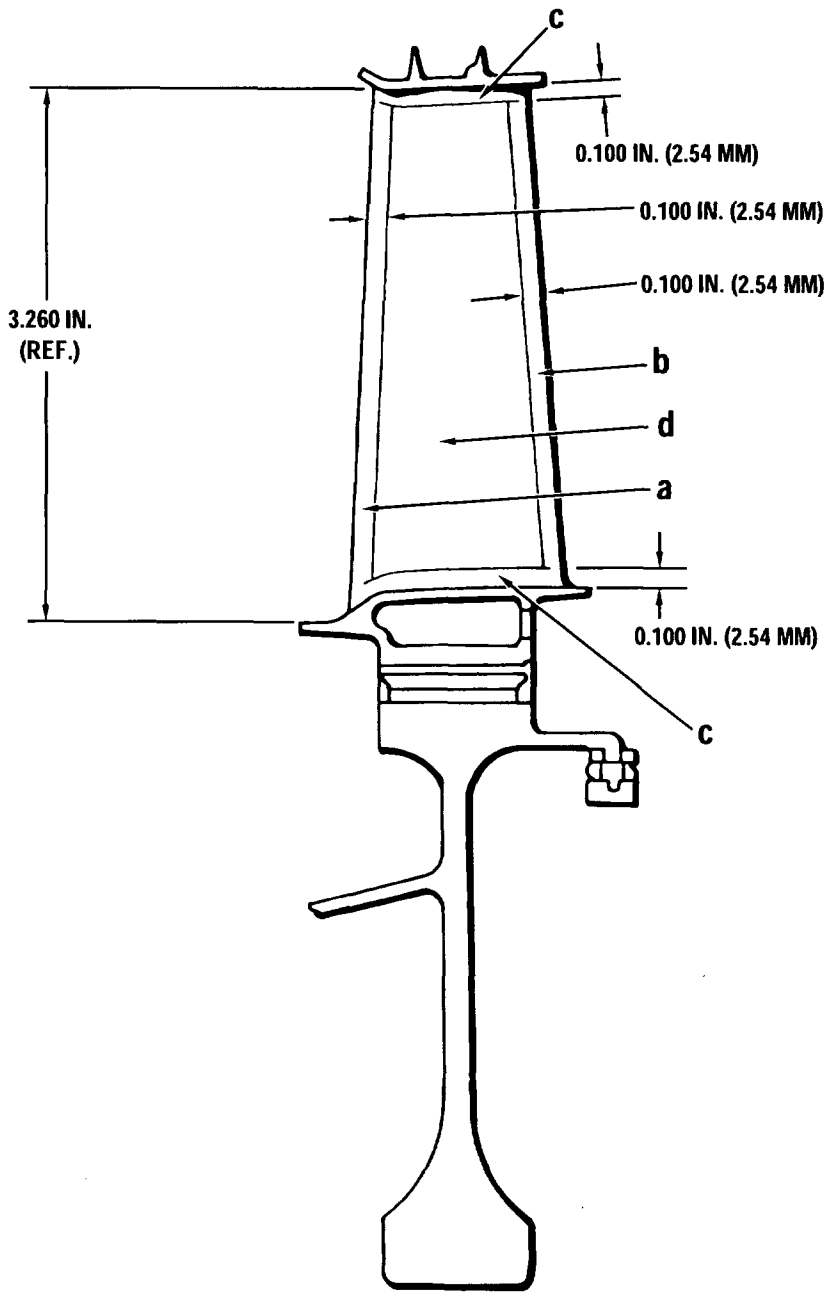
A. Inspection (Ref. Fig. 612 and Table 612)

NOTE: 1. Access for inspection is through the rear of the exhaust duct. Fifth-stage blades may be inspected using a flashlight or borescope.

NOTE: 2. Refer also to Fifth-stage LP Turbine Vane inspection (Ref. Para. 23.).

NOTE: 3. Refer to Borescope Inspection (Ref. Para. 11.).

(1) Inspect Fifth-stage LP turbine blades. Continue inspection until all 68 blades have been inspected.



C19135

Fifth-stage LP Turbine Blades Inspection
Figure 612

TABLE 612, Fifth-stage LP Turbine Blade

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Cracks:			
Areas a and b (leading and trailing edge)	No cracks permitted.	One crack per blade maximum length of 0.050 inch (1.3 mm) if cracks occur on no more than five blades.	More than five blades cracked or any crack longer than 0.050 inch (1.3 mm).
Areas c (inner and outer fillet radii)	No cracks permitted.	N/A	Any cracks.
Bends	One bend permitted in Area b (trailing edge) to a maximum length of 25 percent of trailing edge and a maximum deflection of 0.015 inch (0.38 mm).	N/A	More than one bend in Area b (trailing edge) or bend longer than 25 percent of trailing edge or deflection of bend greater than 0.015 inch (0.38 mm).
Tears	No tears permitted.		
Surface Damage:			
Nicks or dents (Areas a and b)	Permitted to a maximum depth of 0.010 inch (0.25 mm).	N/A	Damage more than 0.010 inch (0.25 mm).
Nicks or dents (Areas c and d)	No damage permitted.	N/A	Damage more than 0.005 inch (0.13 mm).
Sulfidation (NOTE: Sulfidation appears as a green to pale blue color)	No sulfidation permitted.		Sulfidation causing material loss.
Surface Deposits	Deposits related to normal engine running.	Normal deposits with light traces of oil or soot.	Deposits indicating heavy oil leak.

NOTE: If damage is more than limits specified, remove engine and do an overhaul. If an aircraft must be flown to a facility equipped for engine removal, record the extent of damage and submit this information to Pratt & Whitney Canada. A review of the information may permit P&WC to recommend limited engine operation for purposes of obtaining flight permission from the operator's regulatory authority.

23. Fifth-stage LP Turbine Vane

A. Inspection (Ref. Fig. 613 and Table 613)

NOTE: 1. Access for inspection is through the rear of the exhaust duct. Fifth-stage blades may be inspected using a flashlight or borescope.

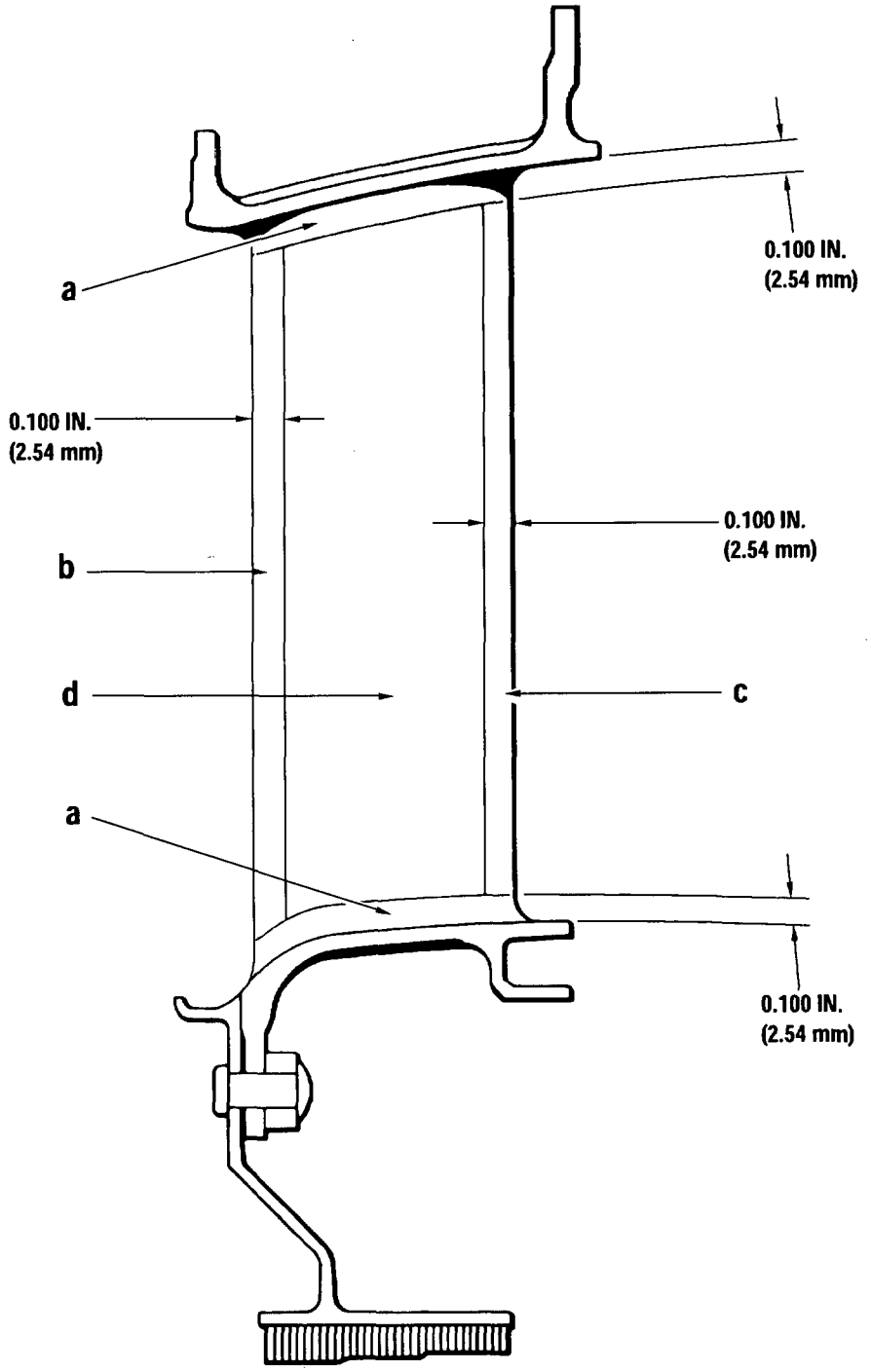
NOTE: 2. Refer to Borescope Inspection (Ref. Para. 11.).

(1) Feed borescope through Fifth-stage turbine blades until Fifth-stage LP turbine vane is visible.

(2) Inspect Fifth-stage turbine vane.

CAUTION: MAKE SURE TIP OF BORESCOPE IS NOT ENGAGED BETWEEN FIFTH-STAGE VANES BEFORE ROTATING LP SHAFT (FAN).

(3) Rotate LP shaft (fan) slowly and repeat until all 74 vanes have been inspected.



C19136

Fifth-stage LP Turbine Vane Inspection
Figure 613

TABLE 613, Fifth-stage LP Turbine Vane

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Cracks:			
Areas a (inner and outer fillet radii)	Length of cracks less than 0.060 inch (1.5 mm).		Any crack longer than 0.060 inch (1.5 mm).
Area c (trailing edge)	Maximum length of 0.300 inch (7.6 mm) and/or maximum length of 0.200 inch (5.0 mm) to a maximum width of 0.010 inch (0.25 mm).		Cracks longer than 0.300 inch (7.6 mm) or cracks with a width greater than 0.010 inch (0.25 mm).
Area d (remainder of vane)	Maximum length of 0.020 inch (0.5 mm) and/or extending from Area c.		Cracks longer than 0.020 inch (0.5 mm).
Tears	No tears permitted.	TBD	TBD
Bends	One bend permitted in Area c (trailing edge) to a maximum length of 25 percent of trailing edge and a maximum deflection of 0.600 inch (1.5 mm).	N/A	More than one bend in Area c (trailing edge) or bend longer than 25 percent of trailing edge or deflection of bend greater than 0.060 inch (1.5 mm).
Surface Damage:			
Nicks or dents (Areas a and b)	No damage permitted.	N/A	
Nicks or dents (Area c)	Permitted to a maximum depth of 0.060 inch (1.5 mm).	N/A	Damage more than 0.060 inch (1.5 mm).
Nicks or dents (Area d)	Permitted to a maximum depth of 0.020 inch (0.5 mm).	N/A	Damage more than 0.062 inch (0.5 mm).
Sulfidation (NOTE: Sulfidation appears as a green to pale blue color)	No sulfidation permitted.	Permitted over a maximum of 40 percent of vane surface if there is no material loss.	Sulfidation causing material loss.

TABLE 613, Fifth-stage LP Turbine Vane (Cont'd)

Inspection Criteria	Acceptable Limits Continue In Service	Acceptable Limits Check at Next MINOR Inspection or before 300 hours.	Perform Hot Section Refurbishment (See NOTE)
Surface Deposits	Deposits related to normal engine running.	Normal deposits with light traces of oil or soot.	Deposits indicating heavy oil leak.

NOTE: If damage is more than limits specified, remove engine and do an overhaul. If an aircraft must be flown to a facility equipped for engine removal, record the extent of damage and submit this information to Pratt & Whitney Canada. A review of the information may permit P&WC to recommend limited engine operation for purposes of obtaining flight permission from the operator's regulatory authority.

24. HP Compressor Rotor

A. Borescope Inspection (Ref. Fig. 614)

(1) Remove compressor inlet cone (Ref. 72-30-01).

(2) Remove low compressor tie rod (Ref. 72-30-01).

(3) Remove fan balancing assembly (Ref. 72-30-01).

(4) Install sleeve spacer (3) (PWC60758) and secure with fan retaining nut (2), handtight.

(5) Disconnect N1 speed probe wiring harness from N1/T4.5 terminal box (Ref. 77-20-01).

(6) Disconnect No. 4 bearing pressure and scavenge oil tubes from exhaust case (Ref. 79-20-03 and 79-20-04).

(7) Disconnect emergency fuel shut-off cable (Ref. 73-10-05).

(8) Disconnect and remove T4.5 "IN" wiring harness connections from N1/T4.5 terminal box (Ref. 77-20-01).

(9) Remove exhaust case (Ref. 72-50-03).

(10) Remove LP turbine module (Ref. 72-50-02).

CAUTION: MAKE SURE NO FOREIGN OBJECTS FALL INSIDE INTERMEDIATE CASE.

(11) Remove LP compressor shaft, No. 1 bearing assembly and housing (Ref. 72-30-01).

CAUTION: USE CARE WHEN INSTALLING GUIDE TUBE ASSEMBLY. DO NOT DAMAGE CARBON SEALS LOCATED IN THE INTERSHAFT SEAL HOUSING.

(12) Carefully insert guide tube (6) of guide tube assembly (1) (PWC61592) inside HP compressor rotor and locate plate (2) on flange of No. 1 bearing support.

(13) Secure plate (2) on No. 1 bearing support flange with two slave nuts (7) and bolts (8).

(14) Loosen knurled screw (4) on guide tube assembly and pull guide tube (6) out to the second-stage position stop (5) (about 2 inches) and tighten knurled screw.

CAUTION: THE BORESCOPE IS A DELICATE DEVICE; IT IS VULNERABLE TO SEVERE SHOCKS, TWISTING AND PINCHING. CARE AND ATTENTION MUST BE EXERCISED WHEN HANDLING IT TO PROLONG ITS SERVICE LIFE.

CAUTION: HEAT CAN SEVERELY DAMAGE FIBERSCOPE. BORESCOPE INSPECTION MUST BE ACCOMPLISHED AFTER ENGINE HAS COOLED TO ACCEPTABLE LEVEL (NORMAL COOL DOWN PERIOD IS 40 MINUTES FROM ENGINE SHUTDOWN). MAXIMUM SUGGESTED WORKING TEMPERATURE IS 66°C (150°F).

(15) Insert flexible tube of borescope in guide tube and connect viewing equipment in accordance with the borescope operating manual.

NOTE: 1. Refer to Borescope Inspection (Ref. Para. 11.).

NOTE: 2. The solid tip of the fibrescope should protrude about 1/4 inch from the guide tube.

(16) Slowly rotate HP compressor rotor by turning the stubshaft at rear of engine. Check area A beween the second and third-stage disks inside the rotor drum for cracks. No cracks are allowed.

(17) If cracks are found, return engine to Overhaul facility for replacement of the HP compressor rotor drum.

(18) Remove flexible tube of borescope from guide tube.

(19) Loosen knurled screw (4) on guide tube assembly and push guide tube (6) in to the third-stage position stop (about 2 inches) and tighten knurled screw.

(20) Insert flexible tube of borescope in guide tube and connect viewing equipment in accordance with the borescope operating manual.

NOTE: The solid tip of the fibrescope should protrude about 1/4 inch from the guide tube.

(21) Slowly rotate HPC rotor by turning the stubshaft at rear of engine and check area B beween the third- and fourth-stage disks inside the rotor drum for cracks. No cracks are allowed.

(22) If cracks are found, return engine to Overhaul facility for replacement of the HP compressor rotor drum.

(23) Remove flexible tube of borescope from guide tube.

(24) Remove two slave nuts (7) and bolts (8) securing guide tube assembly to No. 1 bearing support flange and remove guide tube assembly.

(25) Install LP compressor shaft, No. 1 bearing assembly and housing (Ref. 72-30-01).

(26) Install fan balancing assembly (Ref. 72-30-01).

(27) Install low compressor tie rod (Ref. 72-30-01).

(28) Install compressor inlet cone (Ref. 72-30-01).

(29) Install LP turbine module (Ref. 72-50-02).

(30) Install exhaust case (Ref. 72-50-03).

(31) Install T4.5 "IN" wiring harness connections on N1/T4.5 terminal box (Ref. 77-20-01).

(32) Install No. 4 bearing pressure and scavenge oil tubes on exhaust case (Ref. 79-20-03 and 79-20-04).

(33) Install N1 speed probe wiring harness from N1/T4.5 terminal box (Ref. 77-20-01).

(34) Install emergency fuel shut-off cable (Ref. 73-10-05).

(35) Perform Ground Checks 1, 2, 3, 4 and 5 (Ref. 71-00-00 ADJUSTMENT/TEST).

25. Eddy Current Inspection (PW305A Only)

A. General (Ref. Fig. 615 and 616)

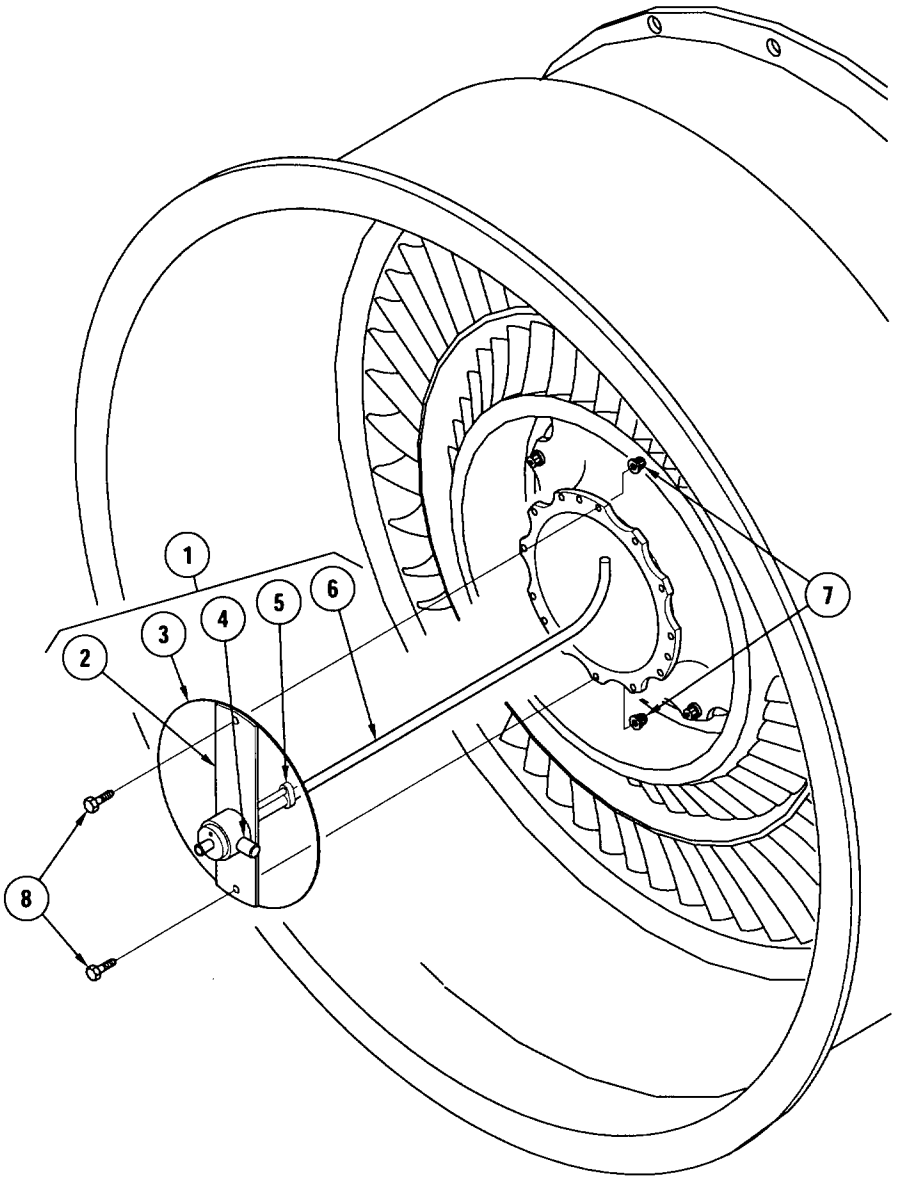
(1) Remove the compressor inlet cone and fan assembly (Ref. Chapter 72-30-01, LP COMPRESSOR - REMOVAL/INSTALLATION).

(2) Remove the compressor inlet vane assembly (Ref. Chapter 72-30-01, LP COMPRESSOR - REMOVAL/INSTALLATION).

(3) Set the Variable Inlet Guide Vane (VIGV) to the half open position, to allow access between the vanes to perform the inspection (Ref. Chapter 75-30-04, VIGV ACTUATOR - MAINTENANCE PRACTICES).

(4) Check the first-stage HP compressor rotor for damage (Ref. Para. 13.). If the damage exceeds the repairable limits, send the engine to an approved Designated Overhaul Facility (DOF) for repair.

(5) Borescope the first-stage HP compressor rotor trailing edge, to check for damage (Ref. Para 11.).

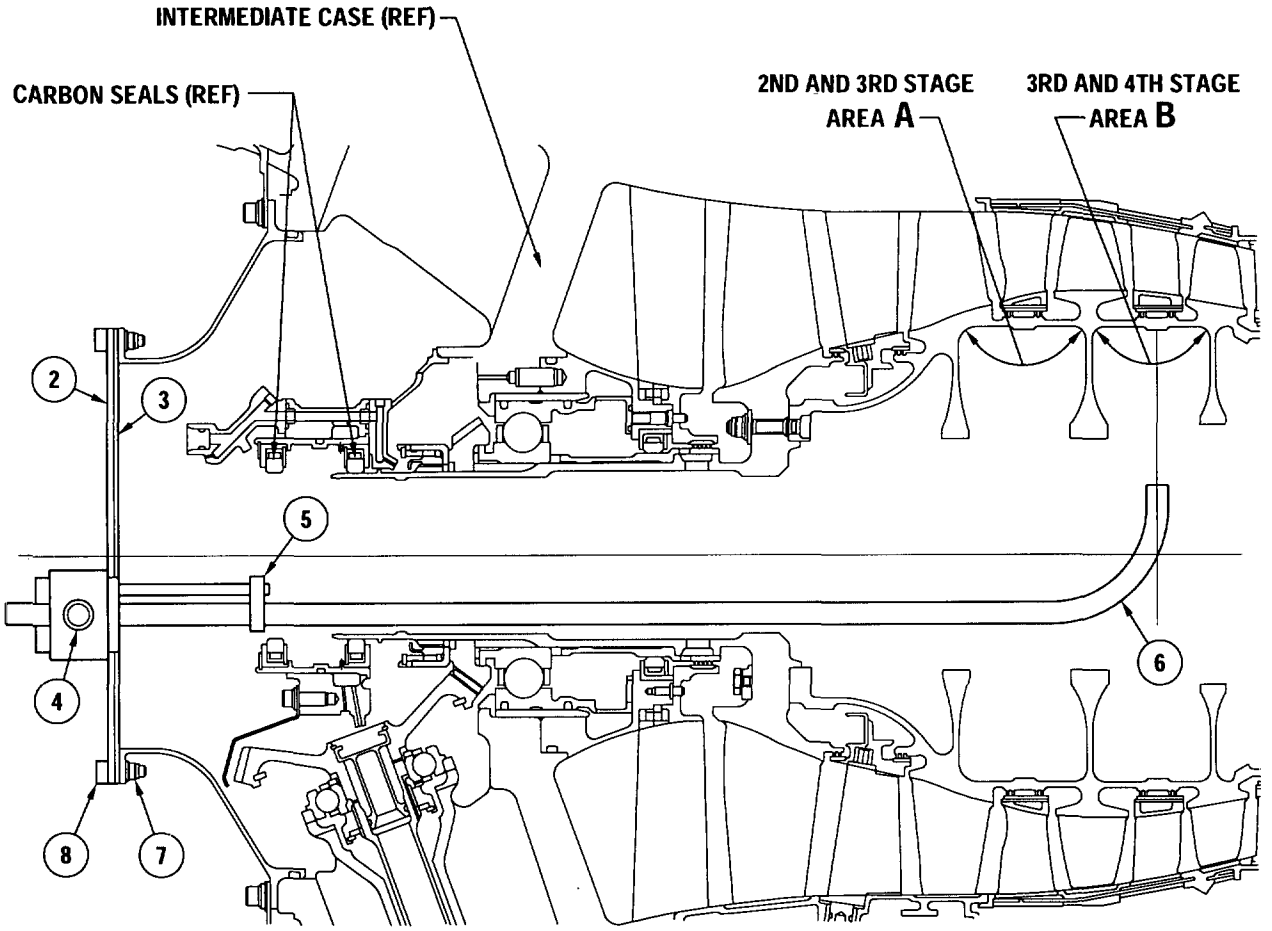


C62308

HP Compressor Rotor - Borescope Inspection
Figure 614 (Sheet 1 of 2)

Key to Figure 614

1. Guide Tube Assembly (PWC61592)
2. Plate (part of item 1)
3. Plexiglass Shield (part of item 1)
4. Knurled Screw (part of item 1)
5. Stop (part of item 1)
6. Guide Tube (part of item 1)
7. Nut (slave)
8. Bolt (slave)



**SECTION THROUGH COMPRESSOR
SHOWING GUIDE TUBE ASSEMBLY INSTALLED**

C62309

HP Compressor Rotor - Borescope Inspection
Figure 614 (Sheet 2)

(6) Clean the blades of the first-stage HP compressor rotor:

NOTE: This procedure is optional, to be done at the operator's discretion.

CAUTION: DO NOT USE CHLORINATED SOLVENTS. THEY CAN CAUSE HYDROGEN EMBRITTLEMENT OF THE TITANIUM SURFACES.

(a) Spray the area to be inspected with cleaner (PWC05-097).

(b) Let the cleaner stay on the parts long enough to dissolve the dirt or contamination.

(c) Wipe the area with a clean, lint-free cloth.

(d) After the area is fully clean, allow sufficient time to dry before you do the eddy current inspection.

(7) Do an Eddy Current inspection of the leading edge of the blades as follows:

(a) Calibrate the eddy current probe P/N US-1645 as follows (Ref. Fig. 615):

1 Apply teflon tape (PWC05-226) on the probe at the blade contact area.

2 Connect the probe and the applicable cable to the Eddy Current Unit (ECU).

3 Set the parameters of the ECU. Refer to the applicable Technique Sheet supplied with the eddy current kit.

NOTE: 1. The Technique Sheets are controlled and updated by P&WC.

NOTE: 2. Applicable Technique Sheets can be obtained by contacting the P&WC Customer Help Desk.

4 Adjust the gain of the ECU as follows:

a Put the probe on the leading edge of the Test Blade 1 approximately 2.0 in. from the rotor platform and press NULL on the ECU.

b Slide the probe between approximately 1.8 to 2.2 in. from the platform. The eddy current signal should be as shown on View A.

c Put the probe on the leading edge of the Test Blade 2 and slide it between approximately 1.8 to 2.2 in. from the platform. The eddy current signal should be as shown on View B.

d Adjust the gain to get a loop signal 3.5 divisions (35% screen height) of upward deflection from the Test Blade 2.

(b) Examine the blades leading edge for cracks as follows (Ref. Fig. 616):

1 If necessary, put a light source inside the engine inlet to light the inspection area.

2 With a suitable marking pencil (PWC05-018) mark a compressor blade. Refer to this as blade No. 1 when you record the results.

3 Put the probe guide on the leading edge of the blade that you marked, approximately 2.0 in. from the platform. Slide the probe, back and forth, between 1.8 to 2.2 in. from the platform.

NOTE: Make sure the probe is seated correctly on the blade leading edge. When the probe is installed and removed from the blade leading edge, there must be a strong lift-off signal displayed. If not, the probe is not correctly installed on the blade.

4 Check the eddy current signal.

NOTE: When you do the inspection, it is possible that the eddy current signal is not in the center of the screen when you move from one blade to another. To correct this, you must NULL the instrument for the applicable blade.

CAUTION: MAKE SURE BLADE IS PROPERLY IDENTIFIED.

5 Mark with an "X" any blade that shows an eddy current signal 2.5 or more major divisions of upward deflection (25% of screen height). Make a note of the position of the blade when you make a report of the inspection results.

NOTE: If an indication is detected that produces a crack like response, do a visual inspection of the blade (Ref. Para. 13.) to make sure that the cause of the indication is not related to a nick or a dent.

6 Do the inspection for all of the blades on the rotor.

7 If a crack is found, complete a download of the Engine Diagnostic Unit (EDU) onto a laptop. Send the results by electronic mail to:

a Customer Help Desk (24-hour service)

US and Canada: 1-800-268-8000
International: 450-647-8000
FAX: 450-647-2888
Email: customerhelpdesk@pwc.ca

8 If a crack is found, send the engine to an approved Designated Overhaul Facility (DOF) for repair.

(8) Do an Eddy Current inspection of the trailing edge of the blades:

(a) Calibrate the eddy current probe P/N US-1635 as follows (Ref. Fig. 615):

1 Apply teflon tape (PWC05-226) on the probe at the blade contact area.

2 Connect the probe P/N US-1635 and the applicable cable to the ECU.

3 Set the parameters of the ECU. Refer to the applicable Technique Sheet supplied with the eddy current kit.

NOTE: The Technique Sheets are controlled and updated by P&WC.

4 Adjust the gain of the ECU as follows:

a Put the probe on the trailing edge of the Test Blade 1 approximately 1.2 in. from the rotor platform and press NULL on the ECU.

b Slide the probe between approximately 1.0 to 1.4 in. from the platform. The eddy current signal should be as shown on View A.

c Put the probe on the trailing edge of the Test Blade 3 and slide it between approximately 1.0 to 1.4 in. from the platform. The eddy current signal should be as shown on View B.

d Adjust the gain to get a loop signal 3.5 divisions (35% screen height) of upward deflection from the Test Blade 3.

(b) Examine the blades trailing edge for cracks as follows (Ref. Fig. 616):

1 If necessary, put a light source inside the engine inlet to light the inspection area.

2 With a suitable marking pencil (PWC05-018) mark a compressor blade. Refer to this as blade No. 1 when you record the results.

3 Put the probe guide on the trailing edge of the blade that you marked, approximately 1.2 in. from the platform. Slide the probe, back and forth, between 1.0 to 1.4 in. from the platform.

NOTE: Make sure the probe is seated correctly on the blade trailing edge. When the probe is installed and removed from the blade trailing edge, there must be a strong lift-off signal displayed. If not, the probe is not correctly installed on the blade.

4 Check the eddy current signal.

NOTE: When you do the inspection, it is possible that the eddy current signal is not in the center of the screen when you move from one blade to another. To correct this, you must NULL the instrument for the applicable blade.

CAUTION: MAKE SURE BLADE IS PROPERLY IDENTIFIED.

5 Mark with an "X" any blade that shows an eddy current signal 2.5 or more major divisions of upward deflection (25% of screen height). Make a note of the position of the blade when you make a report of the inspection results.

NOTE: If an indication is detected that produces a crack like response, do a visual inspection of the blade (Ref. Para. 13.) to make sure that the cause of the indication is not related to a nick or a dent.

6 Do the inspection for all of the blades on the rotor.

7 If a crack is found, complete a download of the Engine Diagnostic Unit (EDU) onto a laptop. Send the results by electronic mail to:

a Customer Help Desk (24-hour service)

US and Canada: 1-800-268-8000
International: 450-647-8000
FAX: 450-647-2888
Email: customerhelpdesk@pwc.ca

8 If a crack is found, send the engine to an approved Designated Overhaul Facility (DOF) for repair.

(9) Adjust the Variable Inlet Guide Vane (VIGV). (Ref. Chapter 75-30-04, VIGV ACTUATOR - MAINTENANCE PRACTICES, Rigging Procedure).

(10) Install the compressor inlet vane assembly (Ref. Chapter 72-30-01, LP COMPRESSOR - REMOVAL/INSTALLATION).

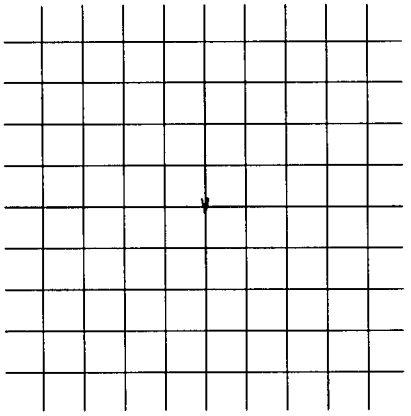
(11) Install the compressor inlet cone and fan assembly (Ref. Chapter 72-30-01, LP COMPRESSOR - REMOVAL/INSTALLATION).

26. In-Service, Low Utilization Engine Inspection

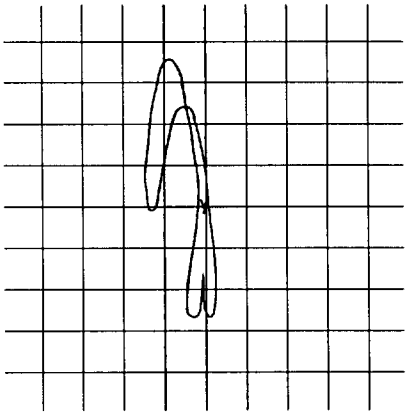
A. Tier 1 Low Utilization Inspection

(1) Refer to Table 614 for in-service low utilization inspection criteria.

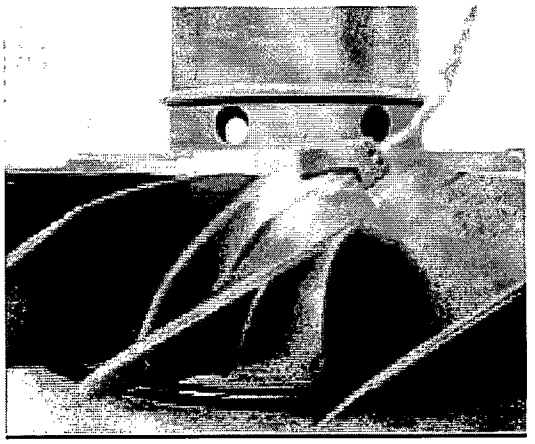
(2) Perform required preservation/depreservation operations (Ref. Chapter 72-00-00, ENGINE - SERVICING).



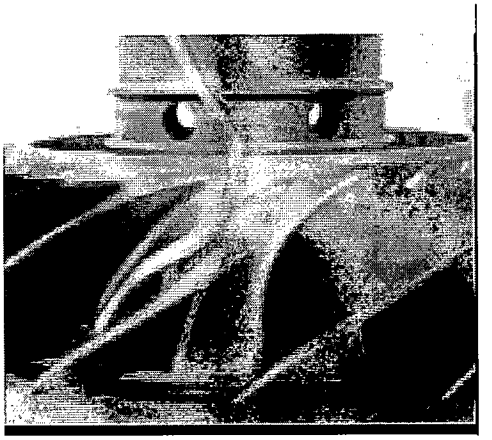
VIEW A
SIGNAL NO INDICATION
TEST BLADE 1



VIEW B
SIGNAL WITH DAMAGE
TEST BLADE 2 AND 3



VIEW C
POSITION OF PROBE US-1645
LEADING EDGE OF TEST BLADE 2

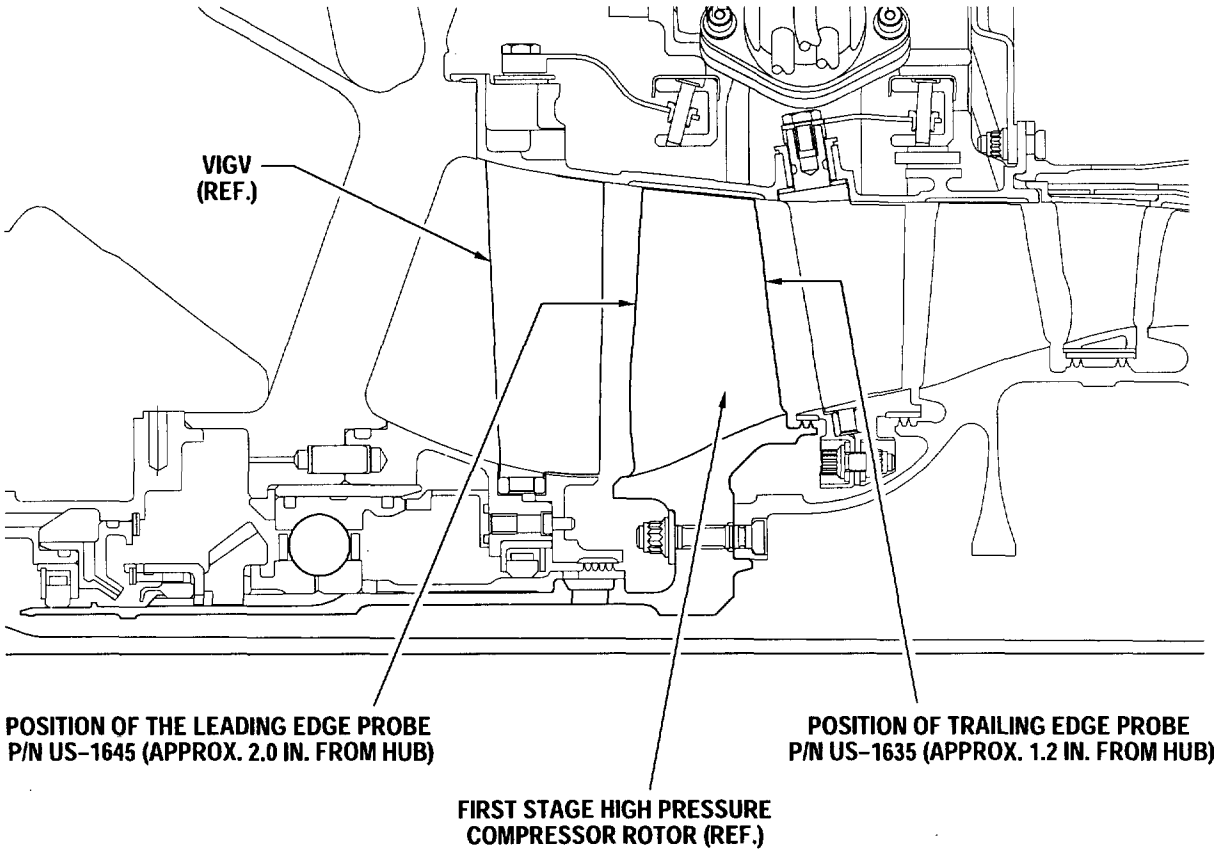


VIEW D
POSITION OF PROBE US-1635
TRAILING EDGE OF TEST BLADE 3

ORIGINAL
As Received By
ATP

C92286A

Calibration of Eddy Current Equipment
Figure 615


VIGV
(REF.)
POSITION OF THE LEADING EDGE PROBE
P/N US-1645 (APPROX. 2.0 IN. FROM HUB)
POSITION OF TRAILING EDGE PROBE
P/N US-1635 (APPROX. 1.2 IN. FROM HUB)
FIRST STAGE HIGH PRESSURE
COMPRESSOR ROTOR (REF.)

C92287

Eddy Current Inspection of First-stage HP Compressor Rotor
Figure 616

TABLE 614, In-Service, Low Utilization Engine Inspection

Component	Nature of Inspection
LP Compressor (Ref. Chapter 72-30-01)	Visually inspect for corrosion.
HP Compressor (Ref. Chapter 72-00-00, INSPECTION)	Borescope and inspect for corrosion.
Combustion Chamber Liner (Ref. Chapter 72-40-01, COMBUSTOR - INSPECTION/CHECK and 72-00-00, ENGINE, GENERAL - INSPECTION)	Borescope and inspect for corrosion.
HP Turbine Vanes and Blades (Ref. Chapter 72-50-01, HP TURBINES - INSPECTION/CHECK)	Borescope and inspect for corrosion.
Structural Cases AGB and Intermediate exterior casings.	Inspect for corrosion.
Emergency Fuel Shut-off Valve (Ref. Chapter 73-10-05, FUEL SHUTOFF AND DRAIN - MAINTENANCE PRACTICES)	Visually inspect all cables and linkages for corrosion and the plunger preformed packing for signs of leakage.
Compressor Bleed Valves (Ref. Chapter 75-30-01, INSPECTION/ CHECK - MAINTENANCE PRACTICES)	Clean as required and inspect for corrosion.
BOV Solenoid (Ref. Chapter 71-00-00, Bleed Valve Operation, POWER PLANT - ADJUSTMENT/TEST)	Perform function check.
N1/T4.5 Terminal Box (Ref. Chapter 77-20-01, T4.5 THERMOCOUPLES - MAINTENANCE PRACTICES)	Clean as required and visually inspect.
Variable Inlet Guide Vane (Ref. Chapter 72-00-00, ENGINE, GENERAL - INSPECTION)	Borescope and inspect for corrosion.
Oil System (Ref. Chapter 79-20-01, OIL FILTER AND HOUSING - MAINTENANCE PRACTICES)	Engine run with filter patch check.

B. Tier 2 Low Utilization Inspection

(1) The Tier 2 Low Utilization Inspection (L.U.I.) must be performed per the following instructions.

(a) Perform an engine internal wash (Ref. 71-00-00, Power Plant Cleaning).

(b) Perform a Power Assurance Test (Ref. 71-00-00, Power Plant Adjustment/Test).

(c) Inspect LP Compressor (Ref. 72-30-01): Inlet Cone, fan Blades, Fan Case, Inner and Outer Vane Ring.

NOTE: 1. For PW305A engines that have accomplished an eddy current Inspection (Ref. 72-00-00, Inspection) during the 5 years period preceding the Tier 2 low utilization inspection, go to step (f).

NOTE: 2. For engines that had replacement of HP compressor rotors or impeller during the 5 years period preceding the Tier 2 low utilization inspection, go to step (f).

(d) Remove Compressor Inlet Cone and Fan Assembly (Ref. 72-30-01).

(e) Remove Compressor Inlet vane (Ref. 72-30-01).

(f) Inspect visible sections of intermediate case for corrosion (Ref. 72-30-01).

(g) Set the variable inlet guide vane to obtain maximum clearance between vanes (Ref. 72-30-01).

(h) Inspect Variable Inlet Guide vane (Ref. 72-00-00).

(i) Inspect First-Stage HP Compressor Blades (Ref. 72-00-00).

(j) Inspect Fourth-Stage HP Compressor Blades (Ref. 72-00-00).

(k) Inspect and Clean Compressor Bleed Valve (Ref. 75-30-01).

(l) Verify Variable Inlet Guide vane rigging (Ref. 75-30-04).

NOTE: For engines that have accomplished a hot section inspection (Ref. 72-00-00, Inspection) during the 5 year period preceding the Tier 2 low utilization inspection, replace steps (m) and (n) with a borescope inspection of the HP and LP Turbine modules (72-00-00, Engine General - Inspection).

(m) Inspect HP Turbine (Ref. 72-50-01, HP Turbines - Inspection/Check).

(n) Inspect LP Turbine Module (Ref. 72-50-02, LP Turbine Module - Inspection/Check).

(o) Inspect Fuel Nozzle (Ref. 72-00-00).

(p) Inspect Combustion Chamber liner (Ref. 72-00-00)

(q) Inspect and test T4.5 System (Ref. 77-20-00)

(r) Verify security of connections inside T4.5 terminal box.

(s) Do a check for fuel and oil leak externally and at drains.

(t) Remove and examine chip detector for debris (Ref. 72-00-00 & 79-20-01).

(u) Inspect chip detector (Ref. 79-30-01).

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(v) Inspect oil filter content for foreign matter and damage (Ref. 79-20-01).

(w) Inspect fuel filter (Ref. 73-10-03).

(x) Clean wiring harness connectors (Ref. 70-00-00, Standard Practice).

(y) Check for security of wiring harness clamps and brackets, and for evidence of wear, chaffing, cracks and corrosion (Ref. 77-20-01).

(z) Check for security tubes connections, clamps and brackets, and for evidence of wear, chaffing, cracks and corrosion (Ref. 70-00-00, Standard Practice).

(aa) Check Emergency Fuel Shut-off Valve cables and linkage for corrosion and damage (Ref. 75-10-05).

(ab) Verify rigging of Emergency Fuel Shut-off Valve (Ref. 75-10-05).

NOTE: 1. All airworthiness directives and all SB's category 1 to 4 must be incorporated during this L.U.I. workscope. Also, category 5 and 6 SB's should be considered for incorporation when access permits.

NOTE: 2. Do not disassemble sub-assemblies unless indicated in the workscope.

TABLE OF CONTENTS

SUBJECT	PAGE
COMPRESSOR SECTION - DESCRIPTION AND OPERATION	**72-30-00**
1. LP Rotor Balancing Assembly and Compressor Inlet Cone Assembly)	1
2. Fan Case and Stator Assemblies)	1
3. LP Compressor Shaft, No. 1 Bearing and Intershaft Seal Housing)	4
4. Intermediate Case Assembly)	4
5. Gas Generator Case/Diffuser Assembly)	7
6. HP Compressor Rotor Balancing Assembly)	7
7. HP Compressor Case)	10
LP COMPRESSOR - REMOVAL/INSTALLATION	**72-30-01**
1. General	401
2. Consumable Materials	401
3. Special Tools	401
4. Fixtures, Equipment and Supplier Tools	402
5. Compressor Inlet Cone	402
A. Removal	402
B. Installation	402
6. LP Compressor Tie Rod	406
A. Removal	406
B. Installation	406
7. Fan Balancing Assembly	407
A. Removal	407
B. Installation	408
C. Fan Clearances	410
D. Fan Spacer Grinding	412
E. Field Replacement of Fan Balancing Assembly (Trim Balancing)	412

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
LP COMPRESSOR - REMOVAL/INSTALLATION (Cont'd)	**72-30-01**
8. Fan Case	415
A. Removal	415
B. Installation	415
9. Inlet Stator Vane Assembly	421
A. Removal	421
B. Installation	422
10. LP Shaft and No. 1 Bearing Housing	422
A. Removal	422
B. Installation	423
11. Fits, Clearances and Torque Loadings	424
A. General	424
B. Dimensional Checks	424
C. Torque Limits	424
LP COMPRESSOR - INSPECTION	**72-30-01**
1. General	601
2. Consumable Materials	601
3. Special Tools	601
4. Fixtures, Equipment and Supplier Tools	601
5. Compressor Inlet Cone	601
A. Inspection	601
6. Fan Blades	602
A. Damage Limits	602
B. Inspection	602
7. Fan Case	604
A. Inspection	604

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
LP COMPRESSOR - INSPECTION (Cont'd)	**72-30-01**
8. Inner and Outer Vane Rings	618
A. Fan Exit Vane Ring	618
B. Compressor Inlet Vane Assembly	618
9. Intermediate Case	621
A. Inspection of Front Flanges	622
B. Inspection of Gas Path Surfaces	622
LP COMPRESSOR - REPAIR	**72-30-01**
1. General	801
2. Consumable Materials	801
3. Special Tools	801
4. Fixtures, Equipment and Supplier Tools	801
5. Fan Blades	801
A. Blend Repairs	801
6. Fan Case	802
A. Repair of Cracks or Holes in Abradable Lining	802
B. Line Maintenance Repair of Delamination of Abradable Lining	803
C. Heavy Maintenance Repair of Delamination of Abradable Lining	803
D. Repair of Cracks or Holes in Perforate Liner	803
7. Intermediate Case Assembly	804
A. Repair of Corrosion or Pitting on Mount Pads and External Surfaces	804
8. LP Compressor Shaft	804
A. Removal of Corrosion on the LP Compressor Shaft Internal Bore	804

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
GAS GENERATOR CASE - INSPECTION/CHECK	**72-30-02**
1. General	601
2. Consumable Materials	601
3. Special Tools	601
4. Fixtures, Equipment and Supplier Tools	601
5. Gas Generator Case Assembly	601
A. Check Diffuser Ducts (Fishtails)	601
B. Check Diffuser Heat Shield	601
C. Check Diffuser Case	603

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Feb 27/2009
	2	Feb 27/2009
Contents	1	Feb 27/2009
	2	Feb 27/2009
	3	Feb 27/2009
	4	Feb 27/2009
72-30-00	1	Nov 19/99
Description and	2	Nov 19/99
Operation	3	Nov 19/99
	4	Nov 19/99
	5	Nov 19/99
	6	Nov 19/99
	7	Nov 19/99
	8	Nov 19/99
	9	Nov 19/99
	10	Nov 19/99
	11	Nov 19/99
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72-30-01	401	Feb 27/2009
Removal/	402	Feb 27/2009
Installation	403	Feb 27/2009
	404	Feb 27/2009
	405	Feb 27/2009
	406	Feb 27/2009
	407	Feb 27/2009
	408	Feb 27/2009
	409	Feb 27/2009
	410	Feb 27/2009
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72-30-01	601	Nov 28/2008
Inspection	602	Nov 28/2008
Check	603	Nov 28/2008
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	622	Nov 28/2008
	623	Nov 28/2008
	624 blank	Nov 28/2008

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
72-30-01	801	Feb 15/2008
Approved	802	Feb 15/2008
Repairs	803	Feb 15/2008
	804	Feb 15/2008
	805	Feb 15/2008
	806	Feb 15/2008
72-30-02	601	Jul 11/2003
Inspection	602	Jul 11/2003
Check	603	Jul 11/2003
	604 blank	Jul 11/2003

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COMPRESSOR SECTION - DESCRIPTION AND OPERATION

1. LP Rotor Balancing Assembly and Compressor Inlet Cone Assembly (Ref. Fig. 1)

The LP rotor balancing assembly and compressor inlet cone assembly are mounted on the front end of the low compressor shaft and are housed by the fan case.

The titanium fan disk mounts 24 titanium fan blades in slots in the disk. An L-shaped retaining ring, riveted to the front balance rim, retains the blades axially at the front. A four-piece "blocker ring", located on the rear of the hub and held in position by a retaining ring riveted to the rear balance rim, retains the blades axially at the rear. The assembly is balanced in two planes by the addition of counterweights riveted to the inner diameter of the front and rear balance rims. The balanced assembly is secured to the low compressor shaft by a cupwasher, fan retaining nut, keywasher and retaining ring.

The compressor inlet cone assembly consists of an inner aluminum cone secured to an outer aluminum shell and mounts to the front of the fan hub with a bayonet style arrangement. A central tie-bolt, mounted in the front of the compressor shaft and retained by a nut, engages the front of the nose cone which in turn is secured to the tie-rod with a drive key and bolt. The hollow tie-bolt provides the passage for hot P2.8 air to the nose cone. Balancing is achieved by material removal at the rear flange and from a flange located near the front of the inner cone.

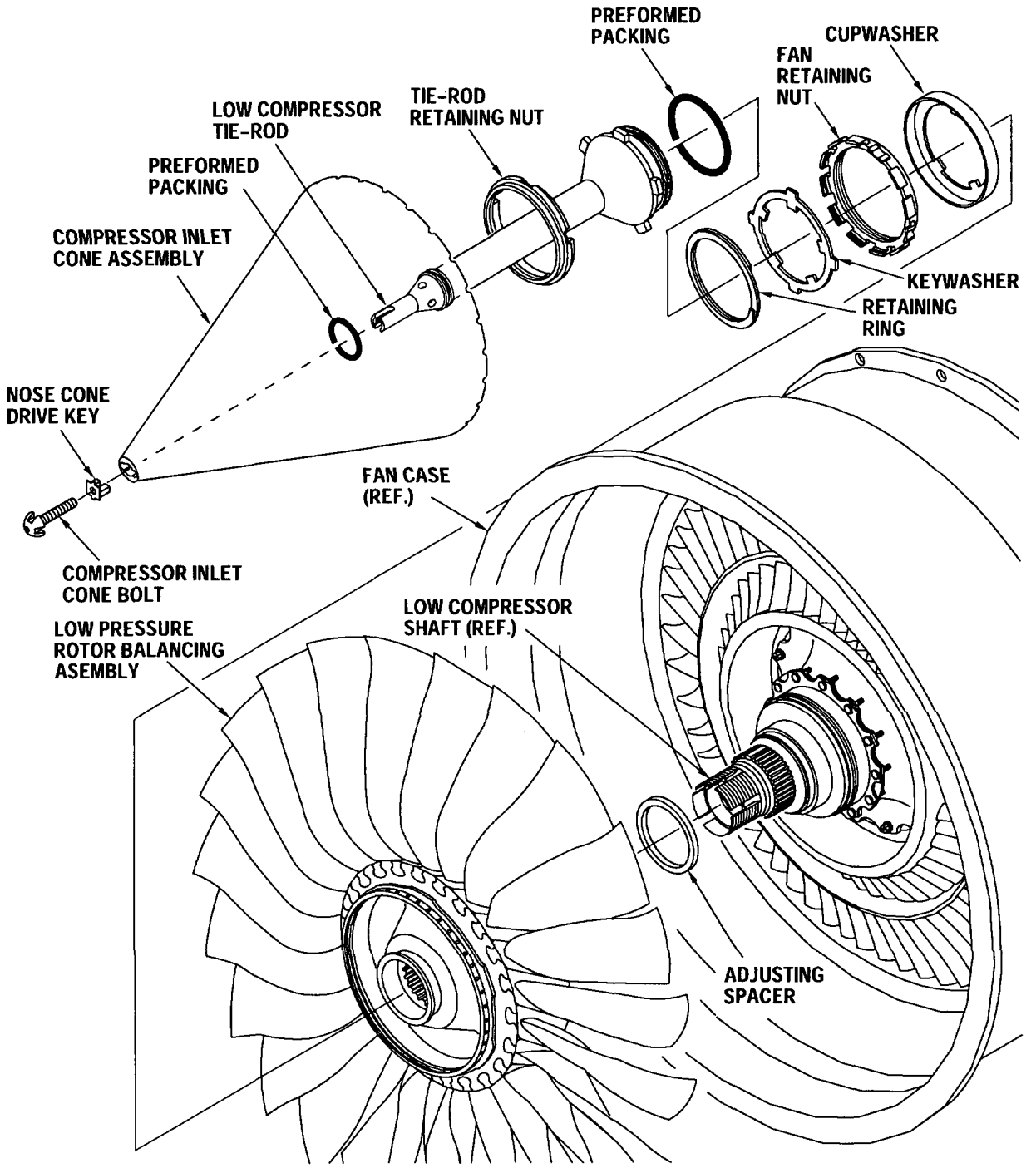
2. Fan Case and Stator Assemblies (Ref. Fig. 2)

The fan case consists of a lightweight aluminum shell, with integral front and rear flanges, covered with a kevlar containment wrap on its exterior. The rear flange is bolted to the intermediate case, while the front flange provides the means of attachment for the airframe-supplied air intake cowling. A shrouded abradable liner of epoxy/glass microballoon composition surrounds the fan on the case inside diameter, and a honeycomb/perforate sheet provides noise suppression forward of, and behind the fan, also on the case inside diameter.

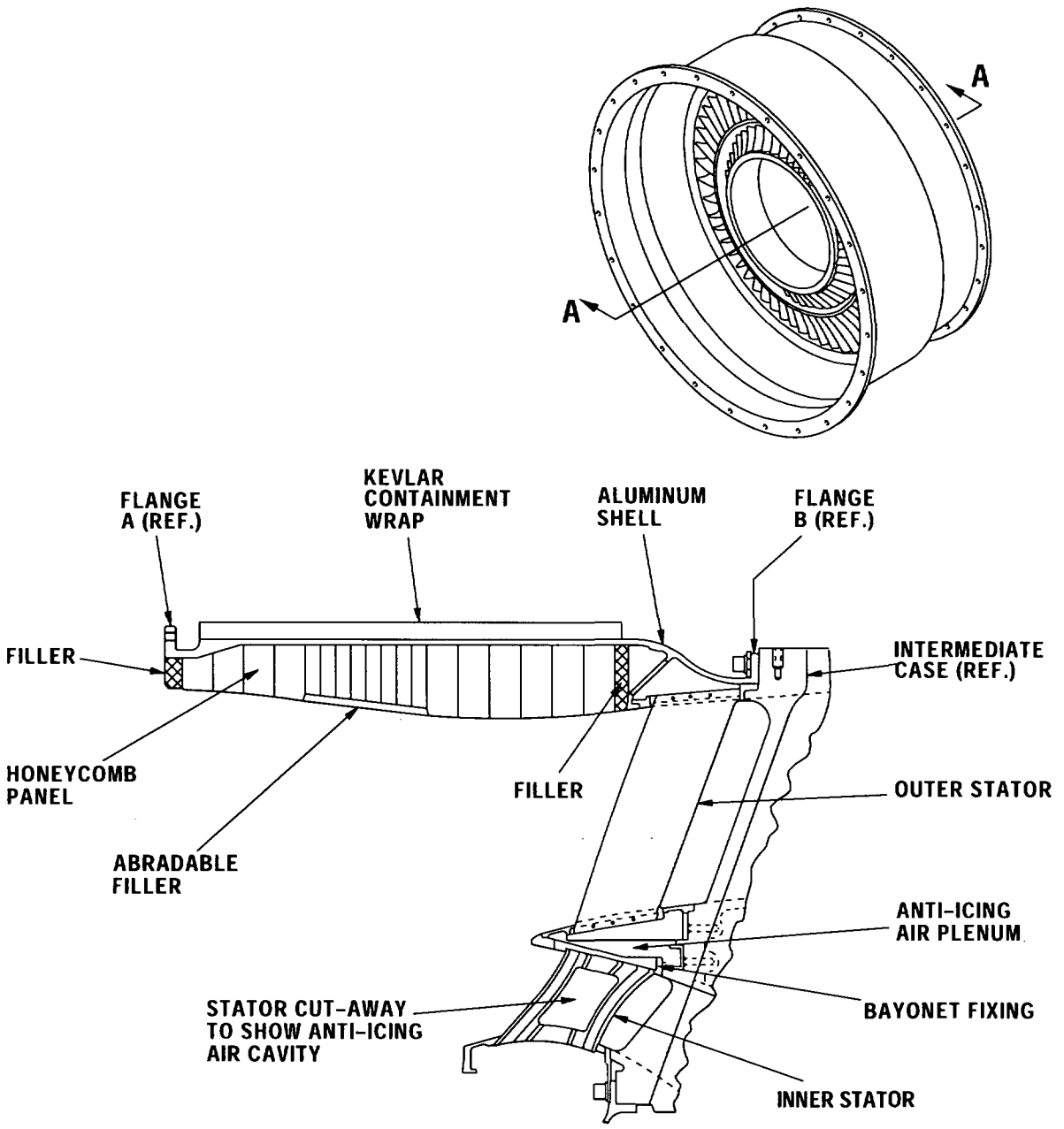
The fan stator assemblies, which consists of concentric inner and outer stator assemblies, divide and direct the airflow from the fan.

The inner stator has a single row of 54 stainless steel guide vanes which direct the airflow through the intermediate case to the high pressure compressor. Each inner vane incorporates anti-icing air channels which direct hot P2.8 air from the outer support shroud cavity along the inside of the leading and trailing edges of the vane. The anti-icing air exits from the vanes into the cavity behind the fan disk, where it is vented into the core airflow. The inner vanes are brazed to their outer shroud, while a silicone rubber potting compound secures the roots of the vanes to the inner shroud. The inner stator assembly locates on the intermediate case with a bayonet fixing on the outer shroud, and is secured to the case at the inner shroud with six bolts.

The outer stator assembly has a single row of 66 aluminum guide vanes, which direct airflow to the bypass duct. The vanes are secured to an inner and outer shroud ring with a silicone rubber potting compound, to form a one-piece assembly. The inner shroud fastens to the intermediate case with six bolts at the rear, and joins with the outer shroud of the inner stator assembly at the front. The two assemblies entrap a steel sleeve which forms a plenum for P2.8 air for anti-icing of the inner stator.



LP Rotor Balancing Assembly and Compressor Inlet Cone Assembly
Figure 1



C30339

Fan Case and Stator Assemblies
Figure 2

3. LP Compressor Shaft, No. 1 Bearing and Intershaft Seal Housing (Ref. Fig. 3)

The LP compressor shaft is a one-piece steel shaft, supported by the No. 1 ball thrust bearing at the front and No. 4 roller bearing at the rear. The balanced shaft assembly contains an internal counterweight, riveted in place midway along the shaft. Slots on the front end of the shaft mate with lugs on the nose cone extension, while a spline mounts the fan balancing assembly. A spline towards the rear end of the shaft mounts the LP turbine assembly, while a thread mounts the N1 speed sensor toothed wheel is mounted. Air seals mounted on both ends of the shaft prevent oil leakage from the No. 1 and 4 bearing compartments. Holes in the shaft allow passage of P3 air for pressurizing of the seals.

The No. 1 bearing compartment consists of a front cover, a support and a housing assembly. The cone shaped support fastens to the front of the intermediate case with 18 bolts and supports the No. 1 bearing cover and housing assembly at its inner flange with 12 bolts. The bearing cover houses a carbon seal and the stationary runner of the labyrinth air seal at the front of the No. 1 bearing and joins with the housing assembly which supports the No. 1 bearing inner race.

The intershaft seal housing bridges the gap between the LP and HP compressor shafts and supports two carbon seals; one at the rear of the No. 1 bearing compartment and one at the front of the No. 2 bearing compartment. The housing connects to the intermediate case and directs pressure oil from the case to the No. 1 and 2 bearing compartments and P3 pressurizing air to the carbon seals and intershaft space.

4. Intermediate Case Assembly (Ref. Fig. 4)

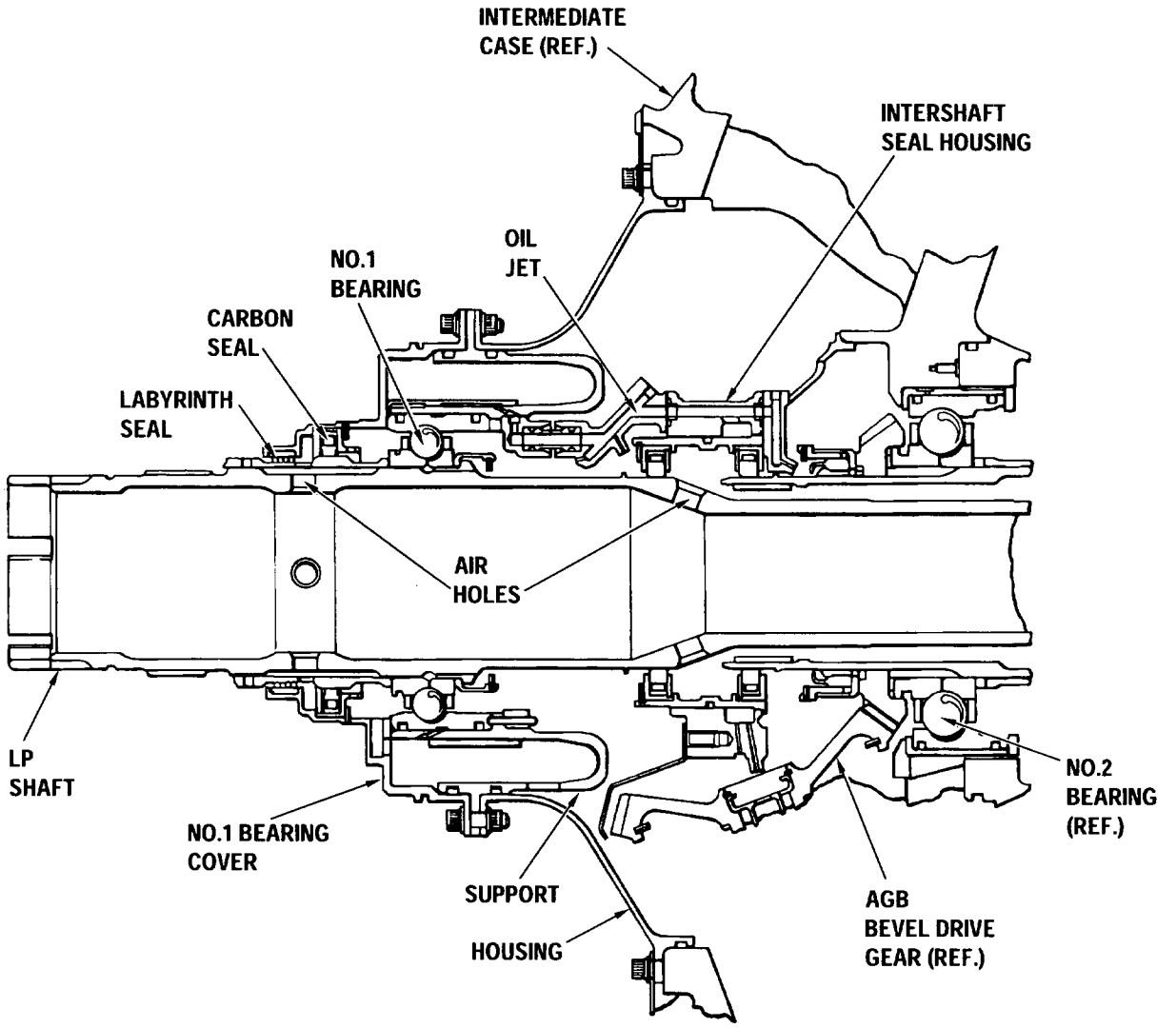
The intermediate case assembly consists of a machined magnesium casting which provides passage for core and bypass airflow through concentric annular passages. The case is the main structural member of the engine carcass; it supports the low pressure compressor case at flange B, the bypass duct at flange C and at its inner rear flange, the gas generator case. The accessory gearbox is suspended from the bottom of the intermediate case. Primary (core) airflow passes through the inner passage to the high pressure compressor rotor while secondary (bypass) airflow passes through the outer passage to the bypass duct. The annular passage walls are joined by six radial struts in the outer passage and airfoil guide struts in the inner passage. The outer and inner struts are located on common radial axes and are all hollow.

The outer wall of the primary passage and the inner wall of the bypass passage are joined at the front and rear to form the annular engine oil tank.

The oil filler neck and transfer tube are located at either the 4 or 8 o'clock position to suit the engine installation and the filler neck is secured to studs and a plate at flange B.

The bore at the rear of the intermediate casing supports the No. 2 oil-damped ball bearing and the variable inlet guide vane shroud hub, while the front face of the bore supports the No. 1 bearing housing assembly by means of a frangible support.

Four mount pads on the outer wall are in line with the four struts located 35 degrees above and below the horizontal centerline. Passageways and bosses provide for oil and air transfer and various accessories.



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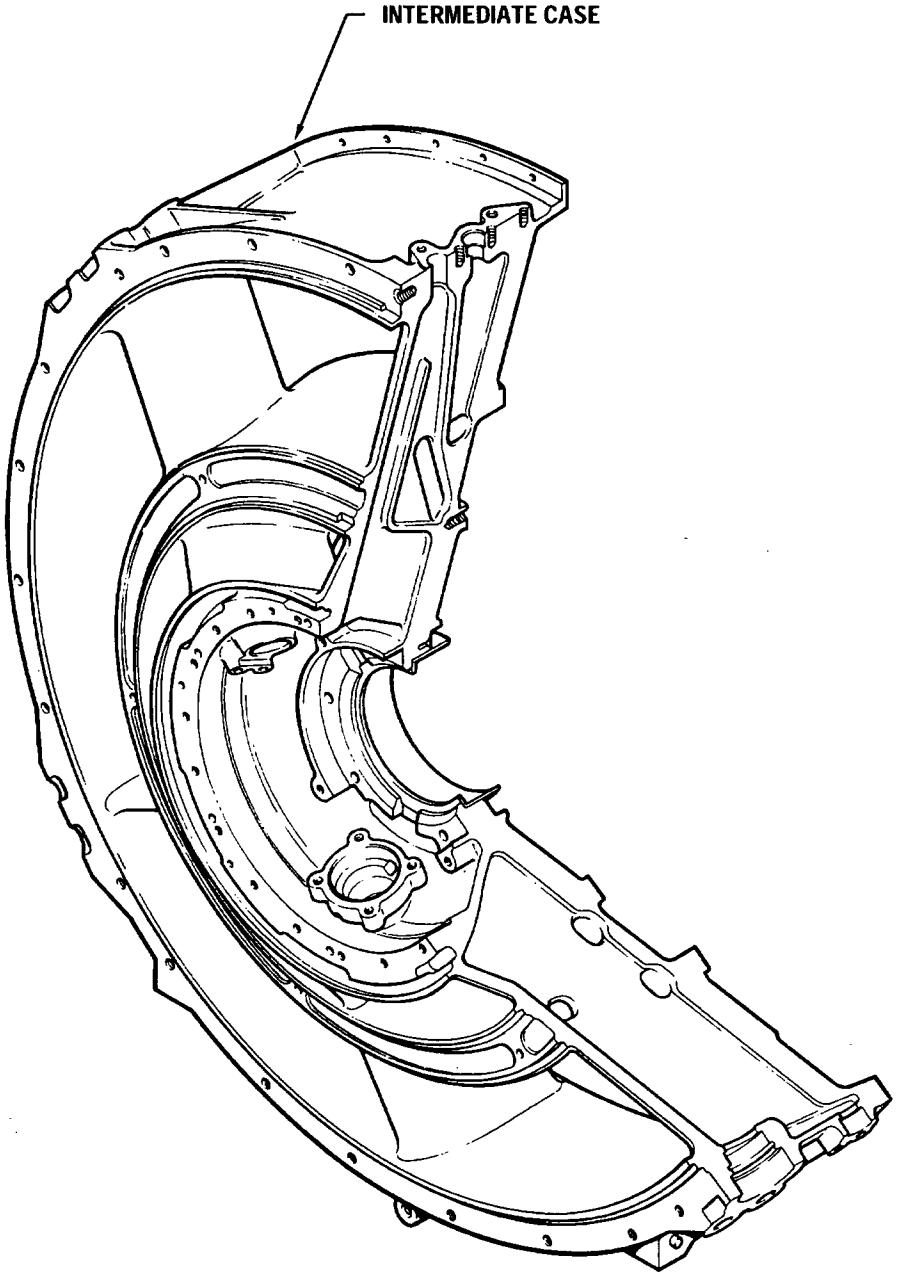
LP Shaft, No. 1 Bearing and Intershaft Seal Housing
Figure 3



C17812

Intermediate Case
Figure 4

5. Gas Generator Case/Diffuser Assembly (Ref. Fig. 5)

The gas generator case is a titanium weldment consisting of an open girder section welded to front and rear flanges and a titanium diffuser off-take section. A sealing face for the impeller housing is embodied at the diffuser inlet while the center section forms the support for the conical No. 3 bearing housing. Internal passageways in the diffuser section direct P2.8 pressurizing air, pressure and scavenge oil to and from the No. 3 bearing compartment.

The front flange is bolted to the intermediate case and the rear flange supports the combustion chamber outer case. Open girder construction allows access to the variable inlet guide vane geometry, compressor bleed valves, anti-icing solenoid valve and starting bleed valve.

The conical No. 3 bearing housing supports the No. 3 roller bearing outer race. The diffuser center section supports the oil nozzle assembly and front and rear carbon seals. Bearing covers mounted on the front and rear of the center section provide thermal protection for the bearing cavity and act as air seals. The rear of the bearing housing also provides a mounting face for the tangential on-board injection nozzle.

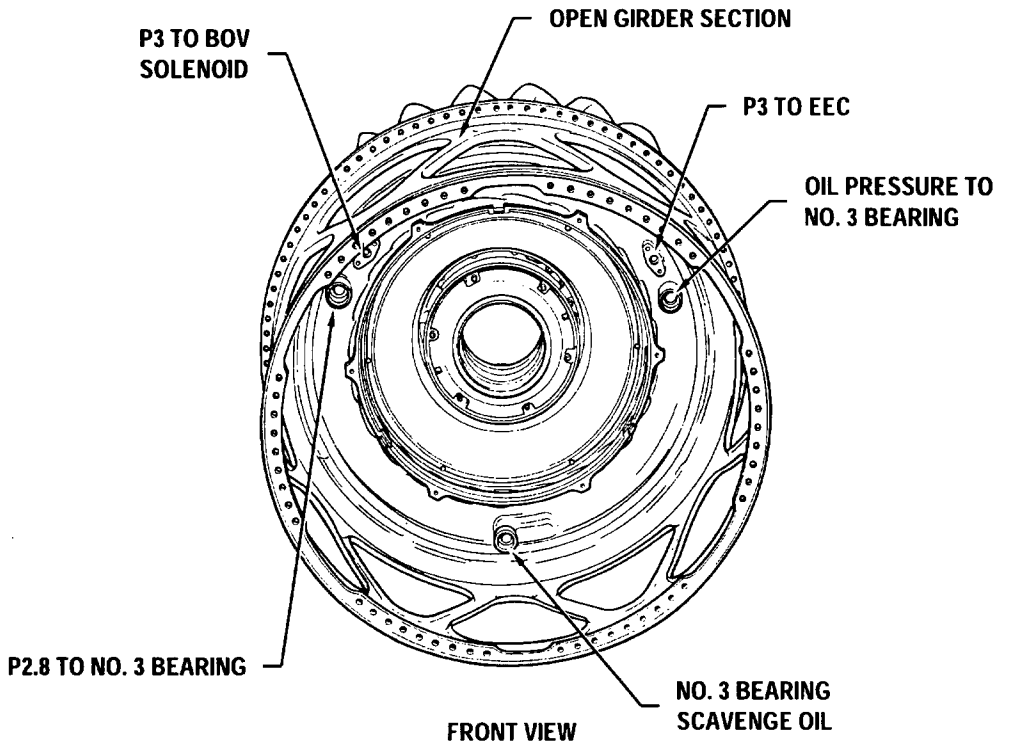
6. HP Compressor Rotor Balancing Assembly (Ref. Fig. 6)

The HP compressor rotor balancing assembly consists of the four-stage axial and one-stage centrifugal HP compressor rotor and the two-stage HP turbine rotor balancing assembly.

The HP compressor rotor consists of four axial stages and a single-stage centrifugal impeller. The first-stage rotor is a one-piece titanium forging, consisting of a shaft, disk and 23 blades (integrally bladed rotor) and is bolted to the front of the compressor assembly with 12 nuts and bolts. The second, third and fourth-stage rotors are also titanium forged blisks, electron-beam welded together to form a one-piece (drum) assembly, thus providing rigidity for tight blade tip clearances. The welded rotor stages have 31, 34 and 39 blades respectively. The 32 vane centrifugal impeller is produced from a titanium forging and is connected to the HP turbine shaft with 15 nuts and bolts to comprise a balanced set. The impeller/shaft set is fastened to the rear of the HP compressor axial stages (drum) with 15 nuts and bolts.

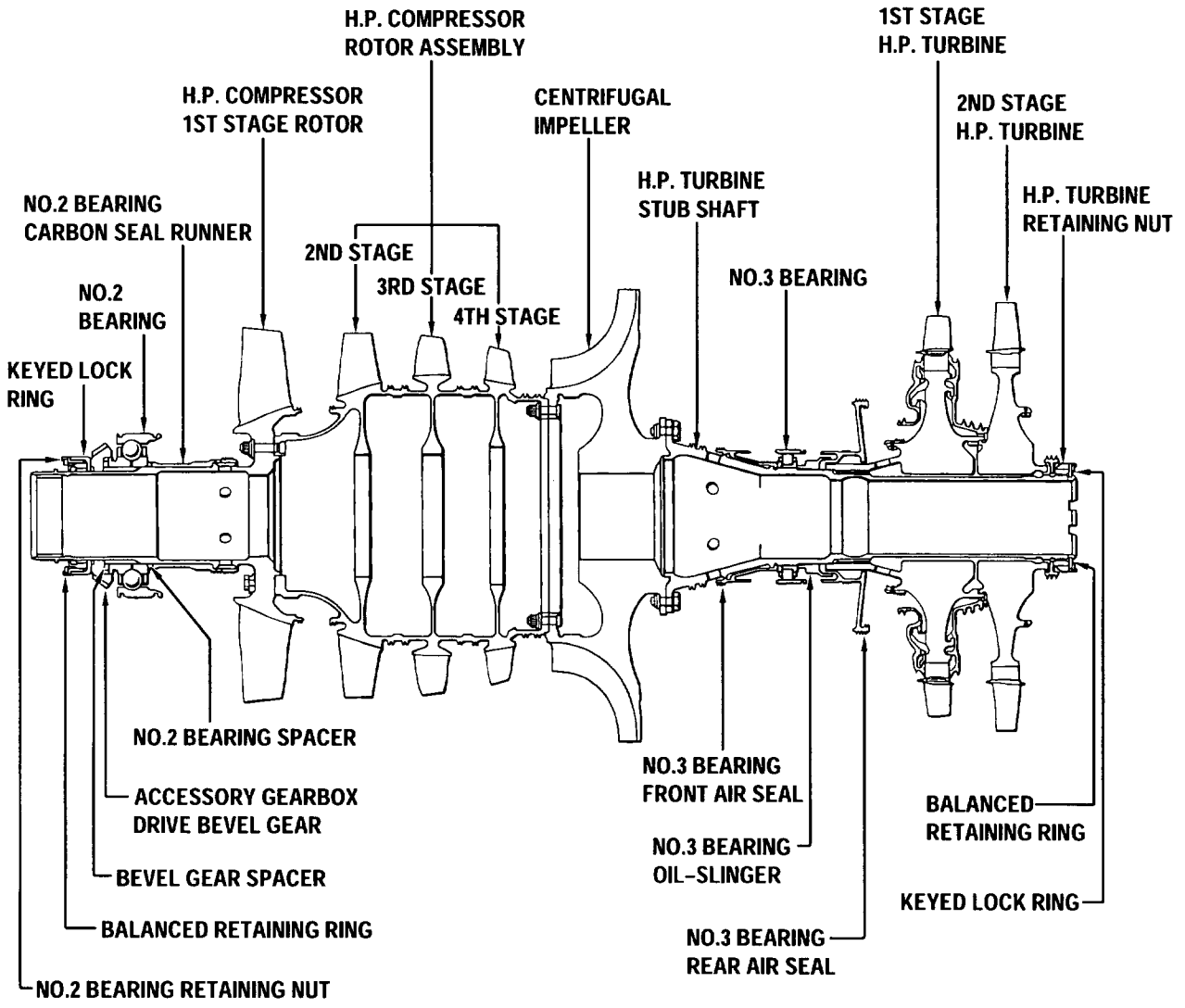
The No. 2 bearing is oil film damped to minimize engine vibration and supports the front end of the compressor rotor balancing assembly in the intermediate case. A carbon seal runner is mounted behind the bearing, while the accessory gearbox bevel drive gear abutts against the front side of the bearing. A keyed lock-ring and nut secures the drive gear on the compressor shaft.

The HP turbine shaft is a hollow steel forging, machined to accommodate the No. 3 bearing front rotor air seal, the oil slinger, the No. 3 roller bearing inner race and the No. 3 bearing rear rotor air seal. The rear rotor air seal also serves as a "pressure balance piston", by transmitting a forward load to the No. 2 ball bearing, from pressurized air behind the No. 3 bearing compartment. Splines on the rear end of the shaft mate with the two-stage HP turbine rotor balancing assembly, while six holes on the conical end of the shaft allow P2.8 pressurizing air from the No. 3 bearing compartment to vent into the intershaft space.



C19741

Gas Generator Case/Diffuser Assembly
Figure 5



C19554

HP Compressor Rotor Balancing Assembly
Figure 6

7. HP Compressor Case (Ref. Fig. 7)

The HP compressor case installation consists of two titanium casings, (front and rear), variable inlet guide vanes (VIGV) and first-stage variable stators with associated unison-ring linkage, and the second, third, and fourth-stage stator assemblies.

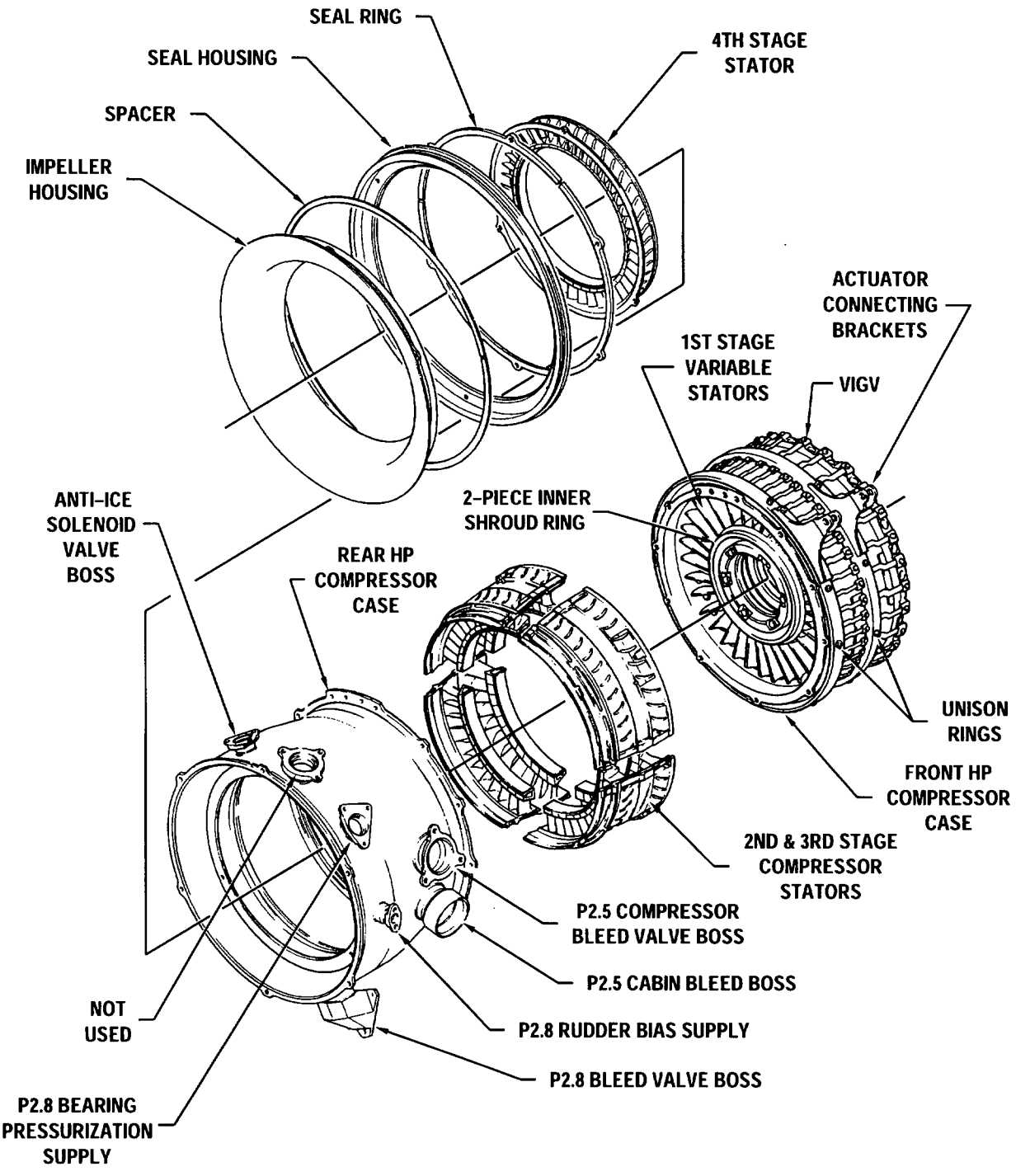
The front case mates with 14 studs on the intermediate case and bolts to the HP compressor rear case with 12 bolts. A row of 29 and 42 bushed holes accommodate the outer spindles of the VIGV and the first-stage variable stators, respectively. An abradable silicone/microballoon glass coating on the front case ID surrounds the first and second-stage rotor path to allow tight blade tip clearance.

An actuator linkage for the variable vanes is mounted on the front case and consists of two unison rings (one per stage) and 71 connector links (one per vane), which connect to the outer spindles. The VIGV inner spindles are supported by a two-piece inner shroud ring which is mounted on the intermediate case with six studs. Pressure oil for the No. 2 bearing and its rear carbon seal is supplied through a passage at the 10 o'clock position on the ring, while a slot in the bottom of the ring allows scavenge oil to pass into a hollow strut in the intermediate case, where gravity drains into the accessory gearbox. The inside diameter (ID) at the rear of the shroud ring assembly acts as the stationary runner for the No. 2 bearing labyrinth air seal. The first-stage compressor stator inner shroud ring assembly is held together with six bolts and forms the stationary runner for the inter-stage air seal between the first and second-stage HP compressor rotors.

The rear case consists of a flanged front and rear section, welded to an intermediate support-ring. The support-ring mounts the fourth-stage stator with three bolts and forms the front of a plenum for P2.8 bleed air. The rear flange supports the impeller shroud housing with six bolts and forms the rear of the plenum. The second and third-stage compressor stators comprise a four-piece segmented stainless steel assembly, having 56 and 48 vanes, respectively. Anti-rotation lugs on the outer platform locate in slots at both ends on the inside of the rear case. Slots, located around the circumference of the outer shroud, allow P2.5 air from the third-stage of the HP compressor to vent to the compressor bleed valves. An abradable coating on the inner shrouds of the stator vanes and around the third and fourth-stage rotor paths provides interstage air sealing.

Nine bosses on the rear case provide for compressor bleed as follows:

- two for P2.5 compressor bleed valves.
- one for P2.8 compressor bleed valve.
- two for cabin bleed air tubes.
- one for P2.8 anti-ice solenoid valve.
- two for airframe supplied rudder bias system.
- one for P2.8 bearing air seal pressurization.



C20036A

HP Compressor Case
Figure 7

LP COMPRESSOR - REMOVAL/INSTALLATION

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-018	Pencil, Metal Marking
PWC06-004	Compound, Antiseize
PWC06-032	Compound, Antigalling and Antiseize
PWC09-003	Compound, Sealing
PWC11-027	Solvent, Petroleum

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name	Application
PWC30128-03	Puller	
PWC32396-100	Jackscrew	
PWC32505	DELETED	Replaced by PWC71392
PWC32506	DELETED	Replaced by PWC89837
PWC32550	Adapter	Obsolete - replaced by PWC41150
PWC37807	Pump	
PWC40724	Holder, Core-Stator	Replaces PWC61783
PWC41050	Wrench	
PWC41150	Adapter	Alternate to PWC32550
PWC43017	Fixture, Lifting	
PWC43238	Riveter	
PWC43239	Set	
PWC43240	Set	
PWC43248	Pad	
PWC43250	Protector	
PWC43251	Container	
PWC43260	Socket	
PWC43261	Socket	
PWC43262	Adapter	

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Tool No.	Name	Application
PWC43264	Puller	
PWC43515-11	Drive Bar	
PWC43537	OBSOLETED	
PWC60085	Set	
PWC60709	OBSOLETED	
PWC60774	Staking Pliers	
PWC63068	Heat Shield	
PWC71392	Adapter	Replaces PWC32505
PWC89837	Cylinder	Replaces PWC32506
PWC90000	Heat Gun	

4. Fixtures, Equipment and Supplier Tools

Not Applicable

5. Compressor Inlet Cone

A. Removal (Ref. Fig. 401)

CAUTION: INLET CONE IS A BALANCED COMPONENT, HANDLE WITH CARE.

(1) Put an index mark on the inlet cone and fan blade in line with the V-mark on the inlet cone using an approved marker (PWC05-018).

(2) Unstake nose cone keywasher (2) using socket (PWC43260).

(3) Remove compressor inlet cone bolt (1) using socket (PWC43260), remove and discard inlet cone keywasher (2).

(4) Remove nose cone drive key (3).

(5) Turn inlet cone (4) 30 degrees and remove.

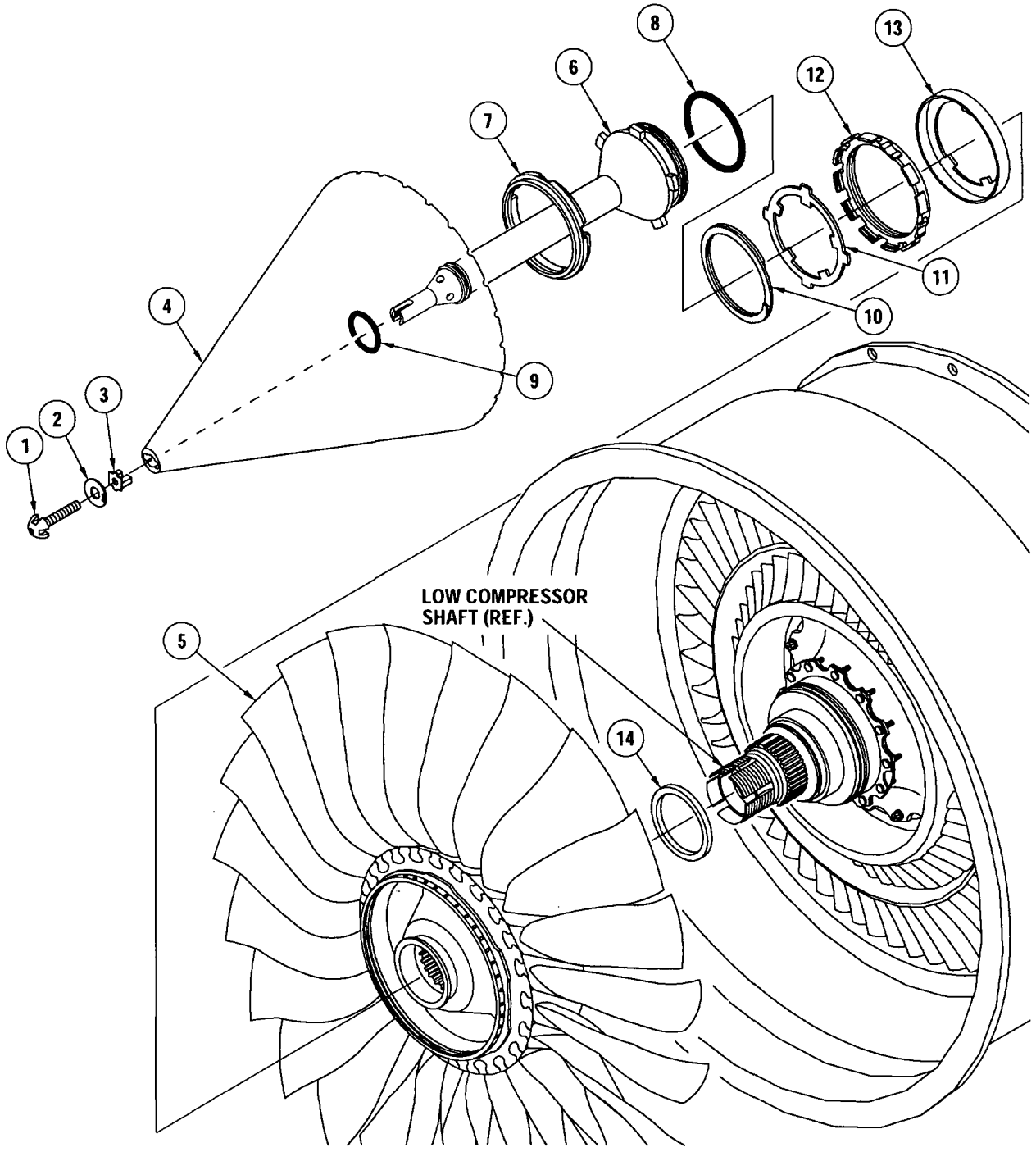
(6) For Pre-SB24279 compressor inlet cone: Remove and discard preformed packing (9).

B. Installation (Ref. Fig. 401)

(1) For Pre-SB24279 compressor inlet cone: Lubricate and install one new preformed packing (9) on compressor tie-rod (6) using engine oil (PWC03-001).

CAUTION: MATERIAL OF FAN ASSEMBLY IS TITANIUM. HANDLE WITH EXTREME CARE USING CLEAN GLOVES. SCRATCHES, NICKS OR ABRASIONS MUST NOT OCCUR.

(2) Turn the fan until the V-mark on the blade retaining ring is at top center. Put a mark on the number one fan blade in line with the V-mark, using an approved marker (PWC05-018).



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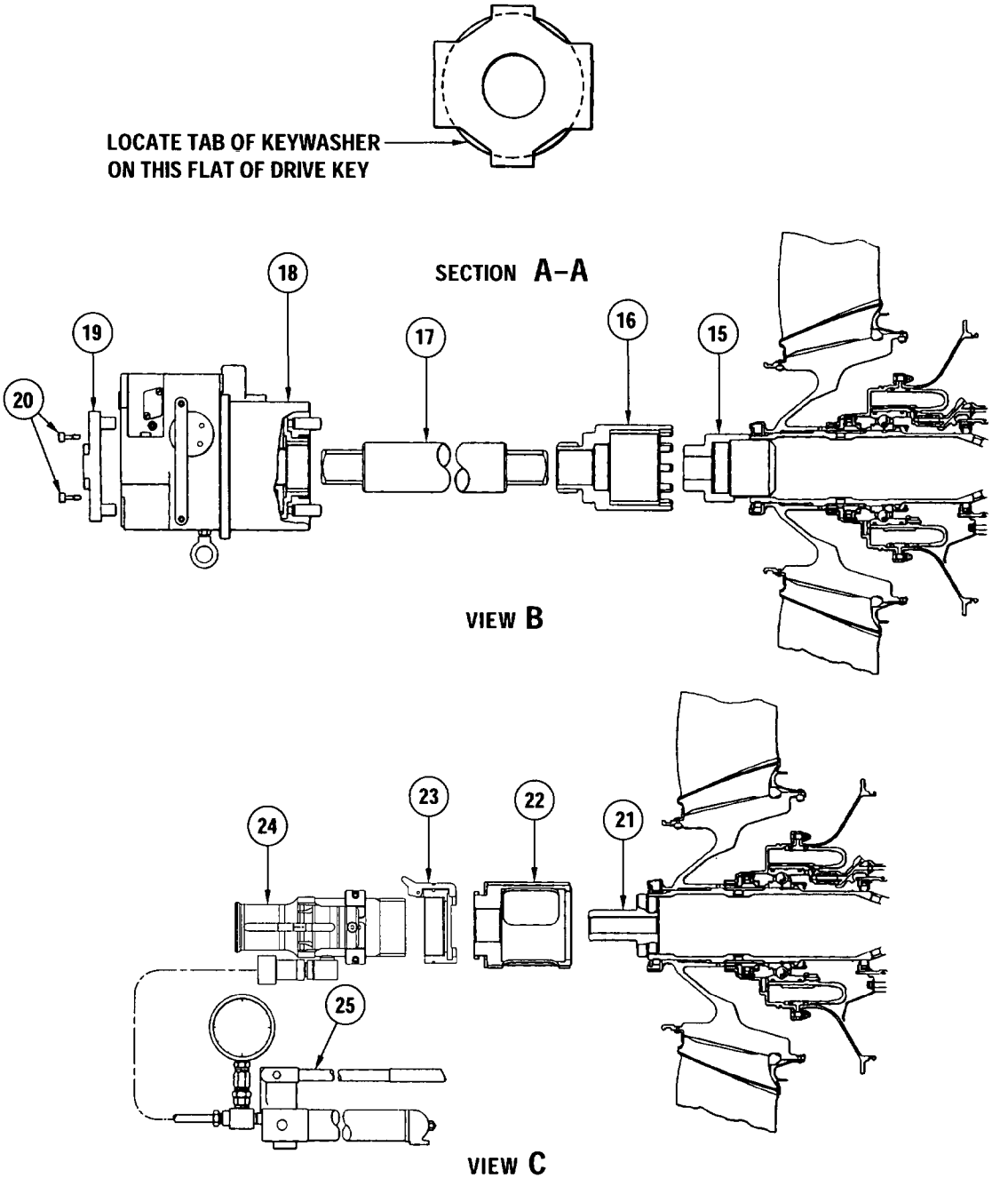
Removal/Installation - Fan Assembly and Compressor Inlet Cone
Figure 401 (Sheet 1 of 2)

Key to Figure 401

1. Compressor Inlet Cone Bolt
2. Nose Cone Keywasher
3. Nose Cone Drive Key
4. Compressor Inlet Cone Assembly
5. Fan Assembly
6. Low Compressor Tie-rod
7. Tie-rod Retaining Nut
8. Preformed Packing
9. Preformed Packing (Pre-SB24279)
10. Retaining Ring
11. Keywasher
12. Fan Retaining Nut
13. Cupwasher
14. Adjusting Spacer
15. Adapter (PWC43262)
16. Socket (PWC43261)
17. Drive Bar (PWC43515-11)
18. Wrench (PWC41050)
19. Adapter (PWC32550)
20. Socket Head Screw (Part of PWC32550)
21. Pad (PWC43248)
22. Puller (PWC43264)
23. Adapter (PWC71392)
24. Cylinder (PWC89837)
25. Hydraulic Pump (PWC37807)



C19740A

Removal/Installation - Fan Assembly and Compressor Inlet Cone
Figure 401 (Sheet 2)

CAUTION: INLET CONE IS A BALANCED COMPONENT, HANDLE WITH CARE.

(3) Install the compressor inlet cone as follows:

(a) For Pre-SB24355: Install inlet cone (4) over low compressor tie-rod (6) so the fan hub assembly and compressor inlet cone slots line up after final assembly.

(b) For Post-SB24355: Install inlet cone (4) over low compressor tie-rod (6) so the "V" marks on the fan hub assembly and compressor inlet cone line up after final assembly.

CAUTION: MAKE SURE THAT THE INLET CONE IS FULLY SEATED ON FAN HUB.

(4) Turn inlet cone until slot in cone align with the slots in the tie rod end.

(5) Install puller (PWC30128-03) into end of tie rod (6) and pull tie rod forward until fully engaged.

(6) Install drive key (3) in inlet cone (4). Turn inlet cone if necessary until drive key can be inserted.

(7) Install keywasher (2) (Ref. Section A-A) and compressor inlet cone bolt (1). Torque bolt using socket (PWC43260) (Ref. Fits and Clearances, REF. NO. 1701).

(8) Stake nose cone keywasher (2) into two opposing slots of inlet cone bolt using pliers (PWC60774).

6. LP Compressor Tie Rod

A. Removal (Ref. Fig. 401)

CAUTION: MATERIAL OF THE TIE-ROD AND RETAINING NUT IS TITANIUM. HANDLE WITH EXTREME CARE USING CLEAN GLOVES.

(1) Push tie-rod (6) rearward until lugs disengage from tie-rod retaining nut (7) using puller (PWC30128-03).

(2) Remove tie-rod retaining nut (7).

(3) Remove tie-rod (6) using puller (PWC30128-03). Remove and discard preformed packing (8).

B. Installation (Ref. Fig. 401)

CAUTION: MATERIAL OF THE TIE ROD AND RETAINING NUT IS TITANIUM. HANDLE WITH EXTREME CARE USING CLEAN GLOVES.

(1) Find and mark the master slot of low compressor shaft, tie-rod retaining nut (7) and master lug of low compressor tie-rod (6) using an approved marker (PWC05-018).

NOTE: Master slot and lug are wider than the others.

CAUTION: MAKE SURE TIE-ROD IS FULLY SEATED.

(2) Lubricate and install one new preformed packings (8) onto low compressor tie-rod (6) using (PWC03-001). Align master lug of tie-rod with master slot of low compressor shaft and insert tie rod.

(3) Install tie-rod retaining nut (7) onto low compressor shaft until contact is made with lugs of tie-rod (6).

(4) Unscrew tie-rod retaining nut (7) until the master slot aligns with master lug of low compressor tie-rod (6). Pull tie-rod forward until lugs of tie-rod engage slots of retaining nut.

7. Fan Balancing Assembly

A. Removal (Ref. Fig. 401)

CAUTION: MATERIAL OF FAN ASSEMBLY IS TITANIUM. HANDLE WITH EXTREME CARE USING CLEAN GLOVES. SCRATCHES, NICKS OR ABRASIONS MUST NOT OCCUR.

(1) Remove retaining ring (10) and keywasher (11).

(2) Unstake cupwasher (12) using unstaking tool (PWC60773).

(3) Install adapter (15) (PWC43262) into end of low compressor shaft (Ref. Sht. 2).

(4) Locate socket (16) (PWC43261) over adapter (15) and onto fan retaining nut (12).

(5) Insert drive bar (17) (PWC43515-11) into end of adapter.

(6) Install wrench (18) (PWC41050) over drive bar and locate on drive spline of socket.

(7) Install adapter (19) (PWC32550) or (PWC41150) on rear of drive bar and rear face of wrench.

(8) Attach adapter to wrench using two socket head screws (20).

(9) Loosen fan retaining nut (12).

(10) Remove previously installed special tooling, fan retaining nut (12) and cupwasher (13). Discard cupwasher.

(11) Record the positions of the trim balancing weights and confirm each position agrees with the trim data recorded in the engine log book (Ref. Fig. 404).

NOTE: Trim balance positions must be quoted if ordering a new fan balancing assembly.

(12) Attached lifting fixture (PWC43017) to a suitable hoist and mount fixture to nose cone mounting rim of fan assembly (5).

(13) Insert pad (PWC43248) into end of low compressor shaft.

(14) Install puller (PWC43264) onto fan assembly (5) and adapter (PWC71392) onto rear of puller and lock adapter.

(15) Screw cylinder (PWC89837) to rear of adapter and connect cylinder hose to hydraulic pump (PWC37807) (Ref. Fig. 401, View C).

(16) Slowly operate hydraulic pump and remove fan assembly (5) from low compressor shaft.

(17) Remove previously installed special tooling.

(18) Place fan assembly in container (PWC43251) and remove lifting fixture.

(19) Remove adjusting spacer (14) from low compressor shaft.

B. Installation (Ref. Fig. 401)

CAUTION: MATERIAL OF FAN BALANCING ASSEMBLY IS TITANIUM. HANDLE WITH EXTREME CARE USING CLEAN GLOVES. SCRATCHES, NICKS OR ABRASIONS MUST NOT OCCUR. USE CONTAINER (PWC43251) FOR STORING AND TRANSPORTING.

(1) Attach lifting fixture (PWC43017) to fan assembly (5). Attach fixture to a suitable overhead crane.

(2) Place heat shield (PWC63068) in the fan hub.

(3) Install heat gun (PWC90000) in heat shield (PWC63068) and heat part for 10 minutes.

NOTE: Set heat gun dial to 10.

(4) Measure and record the thickness of the fan adjusting spacer (14) to nearest 0.0001 inch.

(5) Install adjusting spacer (14) onto low compressor shaft.

(6) Lift fan assembly (5) into position.

CAUTION: MAKE SURE FAN ASSEMBLY IS FULLY SEATED AGAINST ADJUSTING SPACER.

(7) Align master spline of fan assembly (5) with master spline of low compressor shaft. Install fan assembly.

(8) Remove lifting fixture.

(9) Apply a thin coat of antiseize compound (PWC06-032) to the threads and thrust face of slave nut (12) and nut contact face of slave cupwasher (13) or spacer (PWC60903).

(10) Install slave cupwasher or spacer and slave nut.

(11) Torque nut 1200 to 1920 lb.in. (135.6 to 216.9 Nm).

CAUTION: DO NOT EXCEED 1000 lb. ft. (1365 Nm) TORQUE.

(12) Turn nut as follows:

(a) Pre-SB24202; Turn nut thru angle of 40 to 43 degrees.

(b) Post-SB24202; Turn nut thru angle of 42 to 45 degrees.

(13) Measure fan blade tip clearance if necessary (Ref. Para. C.).

(14) Reduce torque on nut (12) to (0.0) lb. in. (0.0 Nm). Remove slave parts and residual antigalling compound from fan shaft.

(15) Make sure that antigalling compound (PWC06-032) has been baked on the threads and thrust face of fan retaining nut (12) prior to installation.

(a) If necessary, put anti-galling compound (PWC06-032) on the fan retaining nut (12) as follows:

WARNING: READ MATERIAL SAFETY DATA SHEET PRIOR TO USING CONSUMABLE MATERIAL.

1 Degrease nut to remove all traces of existing anti-galling compound.

2 Apply one even coat of anti-galling compound (PWC06-032) to the threads and thrust face of nut using a brush or swab.

WARNING: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

3 Bake nut in oven pre-heated 260 to 316°C (500-600°F) for 30 minutes.

(16) Install cup washer (13) and fan retaining nut (12).

(17) Install adapter (15) (PWC43262) into end of low compressor shaft (Ref. Sht. 2).

(18) Install socket (16) (PWC43261) over adapter (15) and onto fan retaining nut (12).

(19) Insert drive bar (17) (PWC43515-11) into end of adapter.

(20) Install wrench (18) (PWC41050) over drive bar and locate on drive spline of socket.

(21) Install adapter (19) (PWC32550) or (PWC41150) on rear of drive bar and locating holes on rear face of wrench. Attach using two socket head screws (20).

(22) Torque fan retaining nut (12) (Ref. Fits and Clearances, REF. NO. 1702).

(23) Remove previously installed special tooling.

(24) Check the match marks to make sure the cupwasher has not shifted.

(25) Measure fan blade tip clearance (Ref. Para. C.).

CAUTION: DO NOT EXCEED 1000 lb. ft. (1365 Nm) TORQUE.

(26) Install keywasher (11) and retaining ring (10).

NOTE: If tangs of keywasher do not align with slots of hub retaining nut (11), nut may be torqued a further 3° maximum to achieve alignment.

(27) Stake cupwasher (13), at four locations, using crimper (PWC60668).

(28) Install compressor inlet cone assembly.

(29) Refer to 71-00-00 ADJUSTMENT/TEST, for checks following installation of fan assembly.

C. Fan Clearances (Ref. Fig. 402)

(1) Load low compressor shaft rearwards.

(2) With each blade loaded to the rear and outward, check LE tip clearance at a common point on the fan case. Find and mark longest fan blade using an approved marker(PWC05-018).

CAUTION: MEASUREMENT SHOULD BE TAKEN AT PORTION OF FAN CASE THAT IS NOT WORN.

(3) With longest blade loaded to the rear and outward, measure and record LE tip clearances at four locations around the fan case (Ref. Fig. 402). Calculate the average clearance and record it as Dim. b. Make sure clearances are within limits specified (Fits and Clearances, REF. NO. 1256).

(4) If fan blade tip clearance is within limits go to step (7).

(a) If fan blade tip clearance is not within limits go to next step.

NOTE: Adjustment of fan clearance, if required, is achieved by varying the thickness of the fan spacer.

(5) Adjust fan clearance, if required, as follows:

(a) Remove fan balancing assembly (5) and adjusting spacer (Ref. Para. A.).

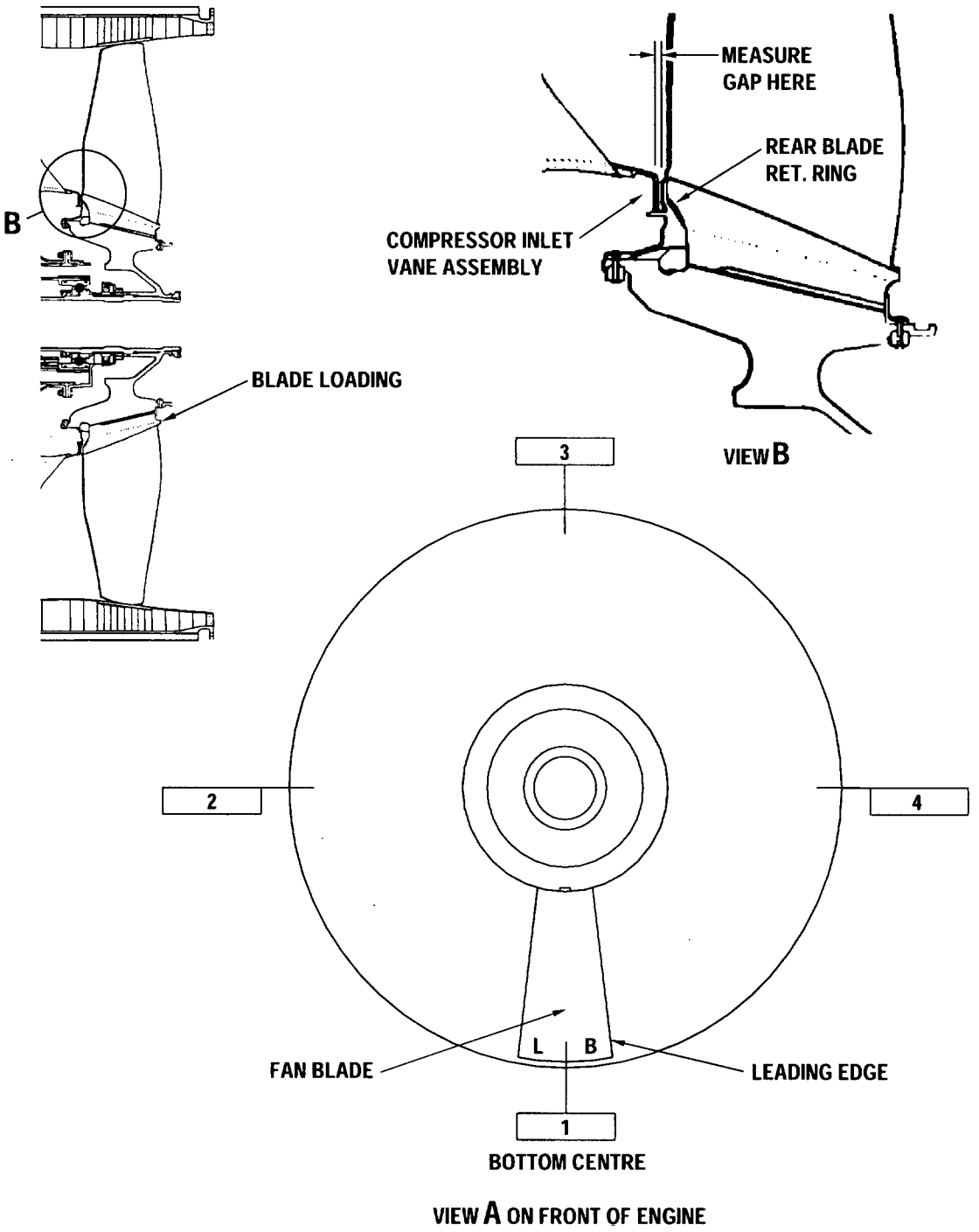
(b) Prepare another fan spacer (Ref. Para. D.).

(6) Repeat steps (1) through (25) (Ref. Para. B.).

(7) Measure the gap between the rear fan blade retaining ring and the compressor inlet vane assembly. There must be a minimum gap of 0.070 inch (1.78 mm) (Ref. View B).

(a) If fan blade tip clearance is within limits go to Para. B., step (14).

(b) If fan blade tip clearance is not within limits go to step (5).



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Fan Balancing Assembly - Fan Clearances
Figure 402

D. Fan Spacer Grinding (Ref. Fig. 403)

(1) Calculate and record the thickness of the fan spacer necessary to bring the fan blade tip clearance within limits using the following formula.

$a = S \pm (C \times 0.01)$ where:

a =	Necessary thickness of fan spacer.
S =	Thickness of the existing fan spacer.
± =	Change in fan blade tip clearance. Use + sign to increase tip clearance. Use - sign to decrease tip clearance.
C =	Necessary change of fan blade tip clearance in 0.001 of an inch.
0.01 =	Calculation factor. A change in fan blade tip clearance of 0.001 inch requires a 0.01 inch change in spacer thickness.

(2) Adjust fan tip clearance by grinding a new or existing adjusting spacer to Dim. a ± 0.0005 inch (0.013 mm) (Ref. Fig. 403).

(3) Faces of spacer must be parallel within 0.0002 inch (0.005 mm), flat within 0.0002 inch (0.005 mm) and have a surface finish of 63 micro-inches or better.

(4) Break sharp edges 0.003 to 0.015 inch (0.08-0.38 mm).

(5) Spray wash spacer (14) using petroleum solvent (PWC11-027).

(6) Check for residual magnetism using a standard field gauge. Negate any residual magnetism.

E. Field Replacement of Fan Balancing Assembly (Trim Balancing) (Ref. Fig. 404)

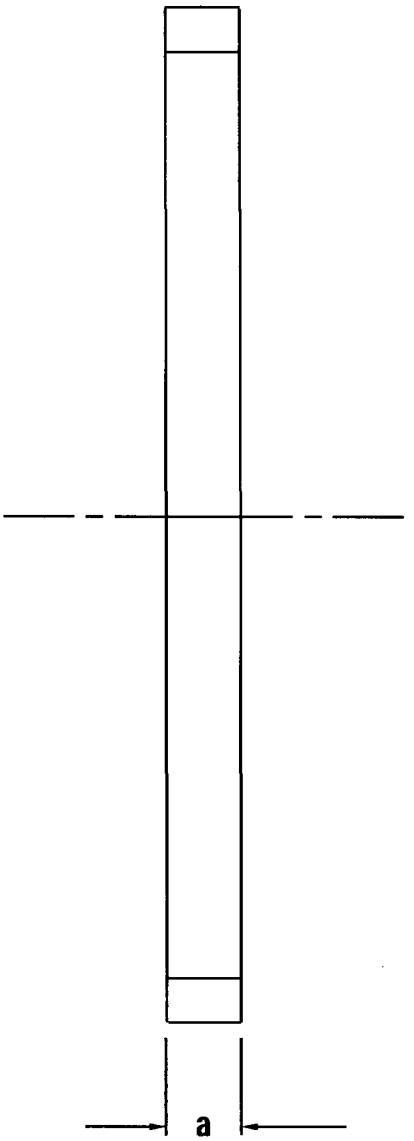
NOTE: Current engine balancing procedures, carried out during engine build, include a requirement to balance the complete LP compressor assembly. To meet this requirement, trim balancing may be necessary. This is achieved by the addition of counterweights to the fan balancing assembly. It is therefore necessary that the following special assembly technique be used, for field replacement of the fan balancing assembly.

(1) Examine the engine log book for fan balancing data. Determine location and class of trim balance weights, then cross-refer to trim balance coding (Ref. Fig. 404). If there is no reference in the engine log book then the replacement rotor may be installed as received.

NOTE: Some engines may not require trim balance adjustments. In such cases the log book entry will read NR (not required).

(2) From recorded data, locate trim balance counterweights on front balancing rim of fan balancing assembly. Remove trim balance counterweights from balancing rim:

(a) Cut off rivet head using a flat chisel.



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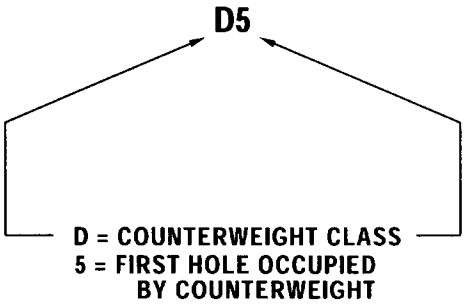
Spacer Grinding - Fan Tip Clearance
Figure 403

FAN BALANCE TRIM WEIGHT VALUES ARE RECORDED IN THE ENGINES LOG BOOK. THE FAN TRIM WEIGHT VALUES CAN BE READ AS FOLLOWS:

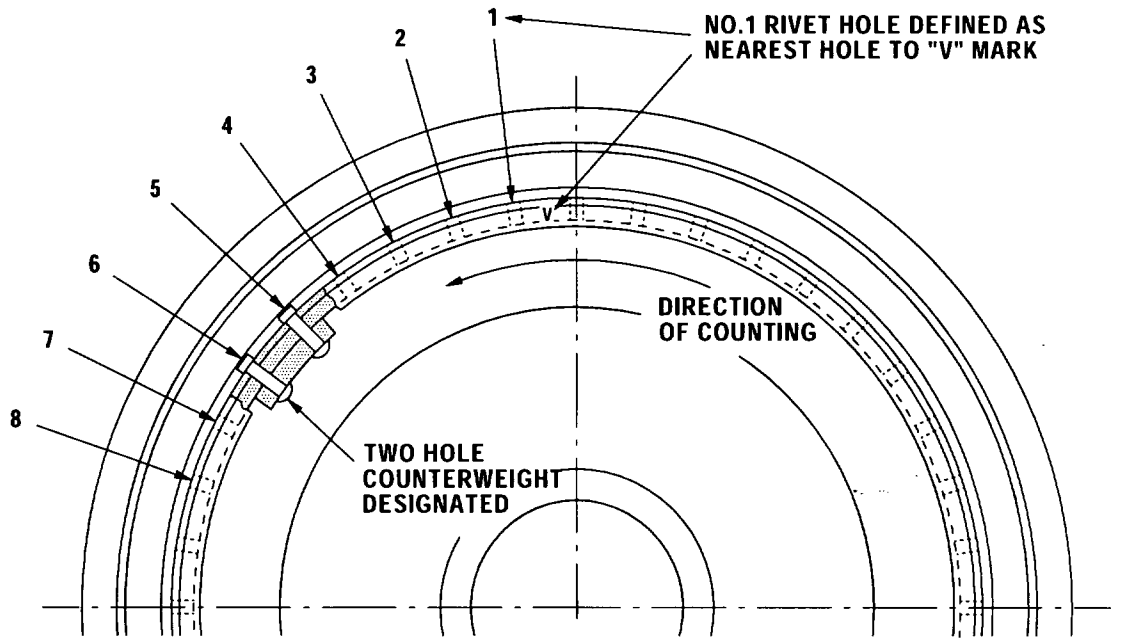
IDENTIFY COUNTERWEIGHTS AS FOLLOWS:

CLASS 1 = A (1 HOLE)
CLASS 2 = B (3 HOLES)
CLASS 4 = D (2 HOLES)
CLASS 6 = F (1 HOLE)
CLASS 7 = G (1 HOLE)



NOTE:

THIS TRIM VALUE SHOWN FOR EXAMPLE ONLY.



VIEW ON FRONT OF LOW PRESSURE ROTOR BALANCING ASSEMBLY

C30440B

Fan Trim Balancing Coding - Applied to Front Balancing Rim
Figure 404

(b) Drive out rivets using a suitable diameter pin punch.

NOTE: Prior to removal, note position of any asymmetric counterweights to ensure correct reinstallation.

(3) Identify trim balance locations on replacement rotor and remove rivets. Install trim balance counterweights removed from rejected rotor. Insert retaining rivets (from inner bore of balancing rim) and secure using riveter (PWC43238) in conjunction with rivet set (PWC43239) and (PWC43240) or (PWC60085).

NOTE: If trim balance weight positions were not quoted when replacement fan was ordered, replacement fan balancing assembly may have detail balance weight(s) in location where trim balance weight(s) are installed. If this occurs, assembly must be returned to be rebalanced in such a way that detail balance weight(s) are relocated.

(4) Install fan assembly (Ref. Para. B.).

8. Fan Case

A. Removal (Ref. Fig. 405)

(1) Remove EEC (Ref. 73-20-02).

(2) Remove 24 nuts (5), four lifting bracket bolts (12) and two lifting brackets (10), 27 washers (11), two brackets (18) and five brackets (19, 20, 21, 22, 23).

(3) Remove nut (4), screw (2) and tube assembly (3).

(4) Install four jacking screws (PWC32396-100) into jacking inserts in fan case Flange B.

(5) Support the weight of the fan case and tighten the jacking screws in a star pattern until the fan case releases from the intermediate case.

(6) Remove fan case (1).

B. Installation (Ref. Fig. 405)

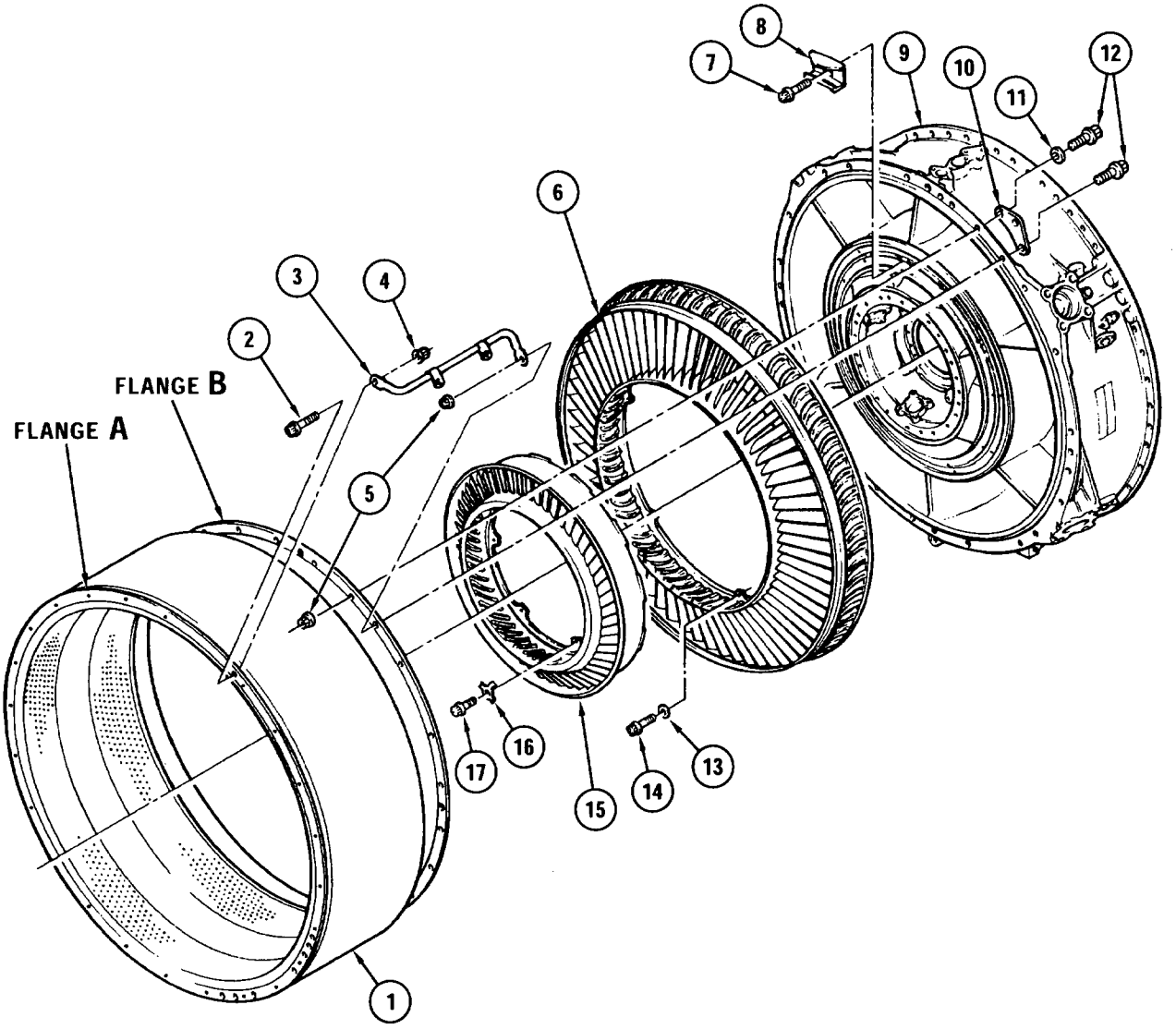
(1) Apply thin layer of sealing compound (PWC09-003) to Flange B of fan case (1).

(2) Align four offset holes on Flange B of fan case (1) with intermediate case (9) and install fan case.

CAUTION: SELF LOCKING NUTS ARE TREATED WITH ANTI-GALLING COMPOUND. DO NOT LUBRICATE.

(3) Secure fan case to Flange B of intermediate case, as follows:

(a) Location A (4 places): Install four bolts (24), four washers (11) and four self-locking nuts (5). Torque 62 to 72 lb.in. (7.0-8.0 Nm).



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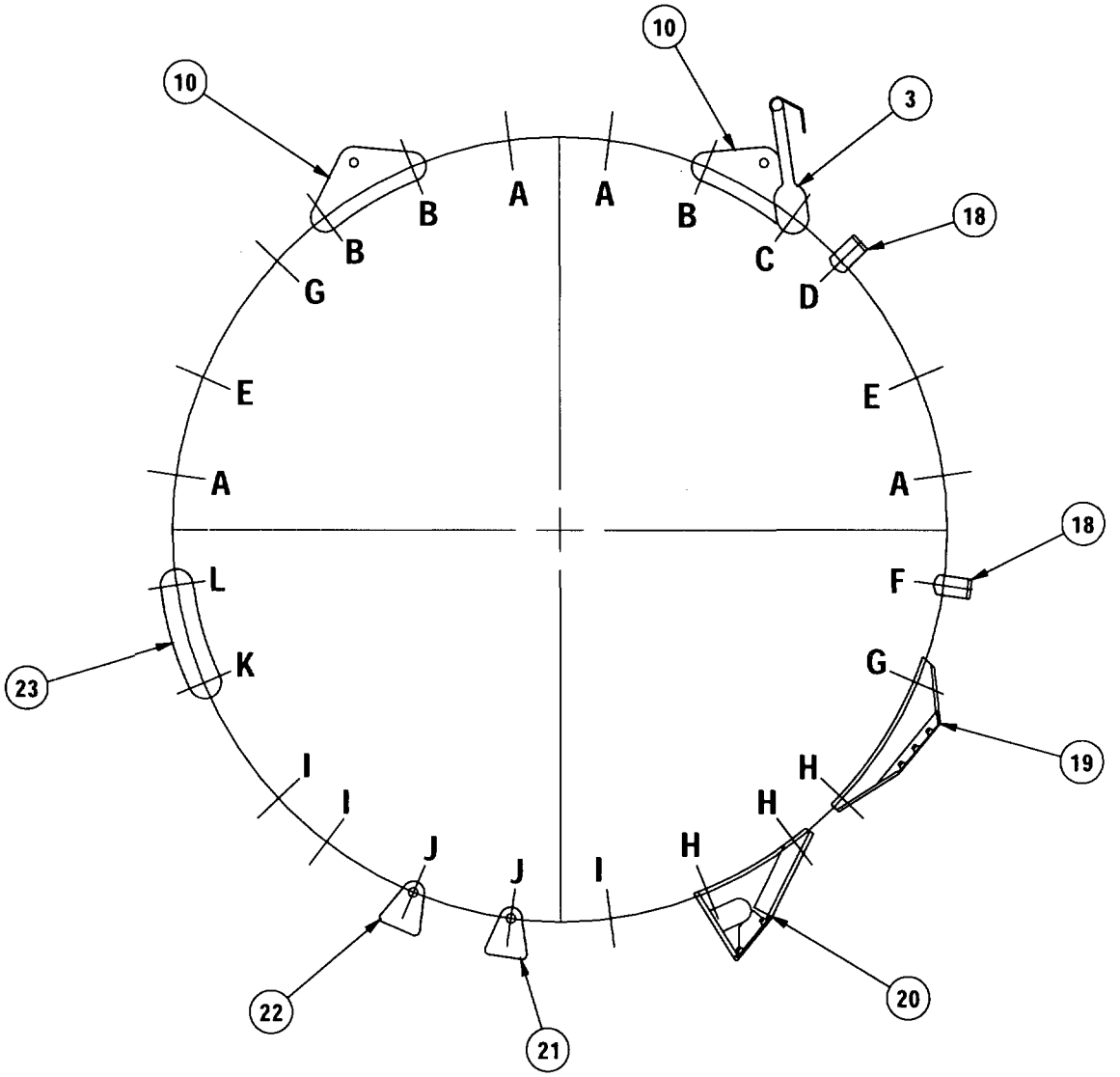
Installation of Fan Case and Vane Assemblies
Figure 405 (Sheet 1 of 4)

Key to Figure 405

1. Fan Case Assembly
2. Screw
3. Support Tube Assembly
4. Nut
5. Nut
6. Fan Exit Vane Ring
7. Bolt
8. Support Bracket
9. Intermediate Case (Ref.)
10. Lifting Bracket
11. Washer
12. Bolt
13. Washer
14. Bolt
15. Compressor Inlet Vane Assembly
16. Washer
17. Bolt
18. Bracket
19. Upper Rear Support Bracket
20. Lower Rear Support Bracket
21. Bracket Assembly
22. Bracket Assembly
23. Bracket
24. Bolt
25. Bolt

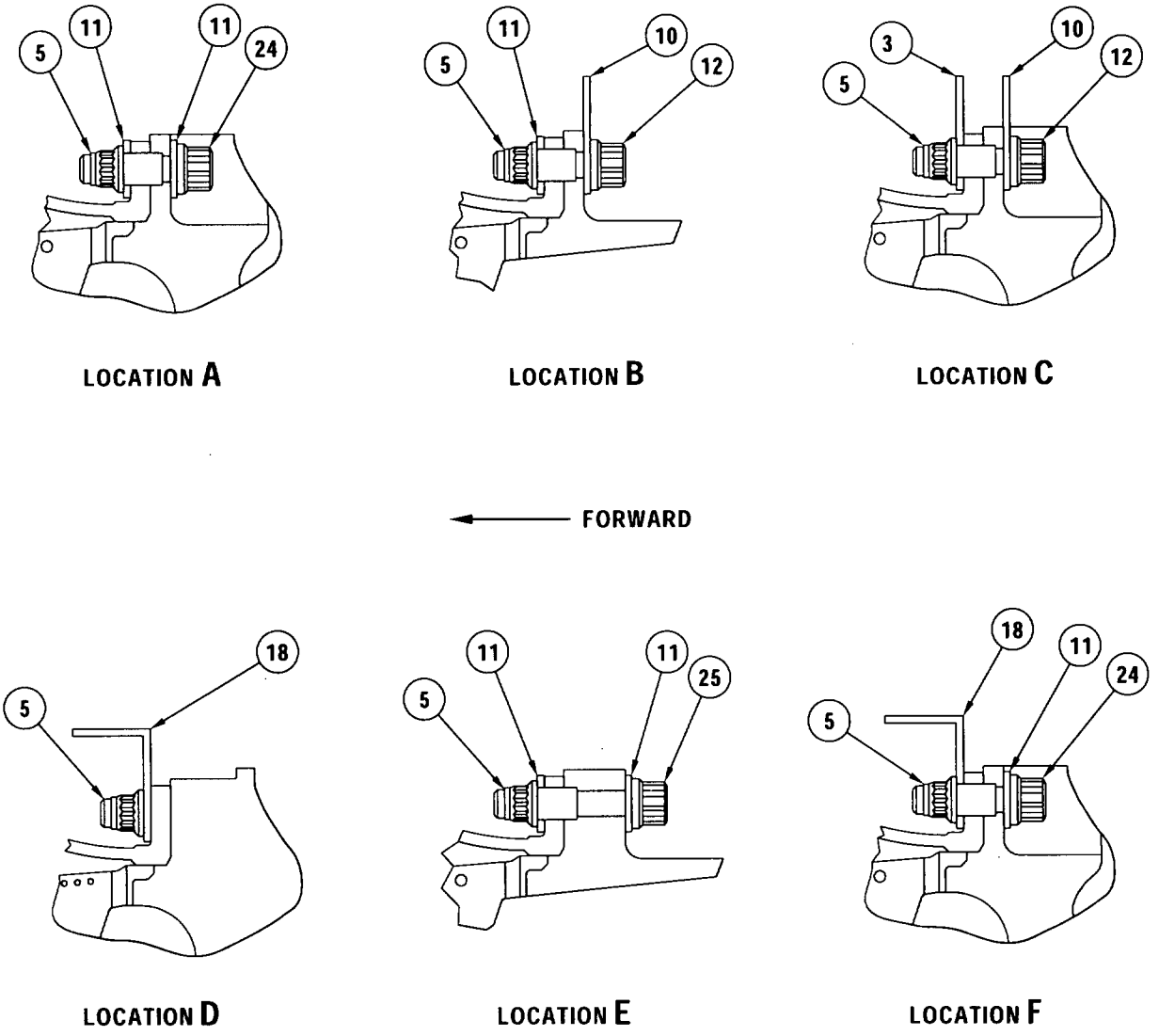
P&WC Proprietary Information. Subject to the restrictions on the title page.



VIEW LOOKING REARWARD ON FLANGE B

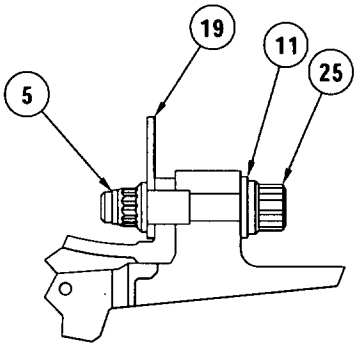
C31468A

Installation of Fan Case and Vane Assemblies
Figure 405 (Sheet 2)

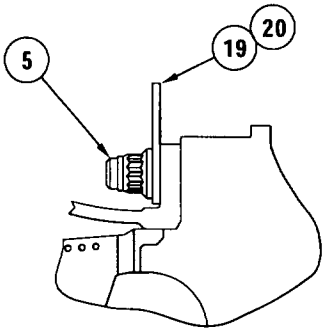


C31466

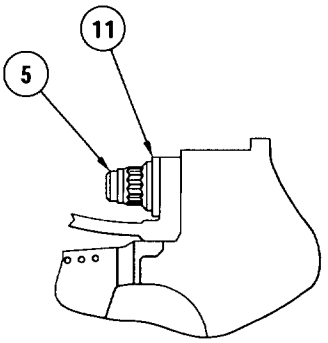
Installation of Fan Case and Vane Assemblies
Figure 405 (Sheet 3)



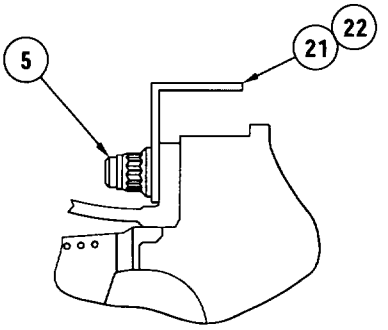
LOCATION G



LOCATION H

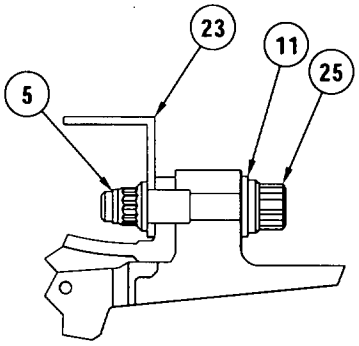


LOCATION I

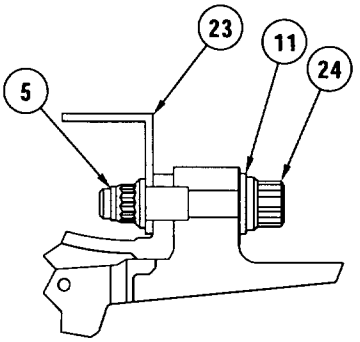


LOCATION J

FORWARD



LOCATION K



LOCATION L

C31467A

Installation of Fan Case and Vane Assemblies
Figure 405 (Sheet 4)

(b) Location I (3 places): Install washers (11) and self-locking nuts (5). Torque 54 to 60 lb.in. (6.0-7.0 Nm).

(c) Location E (2 places): Install bolts (25), two washers (11) and self-locking nuts (5). Torque 62 to 72 lb.in. (7.0-8.0 Nm).

(d) Location L (1 place): Install bolt (24), washer (11), bracket (23) and self-locking nut (5). Torque 62 to 72 lb.in. (7.0-8.0 Nm).

(e) Location K (1 place): Install bolt (25), washer (11) and self-locking nut (5). Torque 62 to 72 lb.in. (7.0-8.0 Nm).

(f) Location F (1 place): Install bolt (24), washer (11), bracket (18) and self-locking nut (5). Torque 62 to 72 lb.in. (7.0-8.0 Nm).

(g) Location H (2 places): Install support bracket (20) (Ref. Sheet 2) washers (11), and self-locking nuts (5). Torque 54 to 60 lb.in. (6.0-7.0 Nm).

(h) Location H (1 place): Install support bracket (19) (Ref. Sheet 2) washers (11), and self-locking nut (5). Torque 54 to 60 lb.in. (6.0-7.0 Nm).

(i) Location G (1 place): Install bolt (25), washer (11) and self-locking nut (5). Torque 62 to 72 lb.in. (7.0-8.0 Nm).

(j) Location J (2 place): Install bracket (21) (Ref. Sheet 2) and self-locking nut (5). Torque 54 to 60 lb.in. (6.0-7.0 Nm).

(k) Location J (1 place): Install bracket (22) (Ref. Sheet 2) and self-locking nut (5). Torque 54 to 60 lb.in. (6.0-7.0 Nm).

(l) Location B (2 places): Install bolts (12), lifting bracket (10), washers (11) and self-locking nuts (5). Torque 62 to 72 lb.in. (7.0-8.0 Nm).

(m) Location B (1 places): Install bolt (12), lifting bracket (10), washer (11) and self-locking nut (5). Torque 62 to 72 lb.in. (7.0-8.0 Nm).

(n) Location C (1 place): Install bolt (12), support tube (3) and self-locking nut (5). Torque 62 to 72 lb.in. (7.0-8.0 Nm).

(o) Location D (1 place): Install bracket (18) and self-locking nut (5). Torque 54 to 60 lb.in. (6.0-7.0 Nm).

(4) Secure front of support tube (3) to Flange A with screw (2) and nut (4). Torque nut 36 to 40 lb.in. (4.0-4.6 Nm).

(5) Install EEC (Ref. 73-20-02).

9. Inlet Stator Vane Assembly

A. Removal (Ref. Fig. 405)

(1) Unlock six washers (16) and remove with six bolts (17).

(2) Disengage lugs of compressor inlet vane (15) from brackets (8) with core-stator holder (PWC40724) and remove vane.

(3) Remove 12 bolts (7), brackets (8), bolts (14), washers (13) and remove fan exit vane assembly (6).

B. Installation (Ref. Fig. 405)

(1) Position drain hole on the bottom of fan exit vane (6) at bottom of engine, align three lugs on fan exit vane with three slots on intermediate case (9) and install vane.

(2) Secure vane (6) with six washers (13) and six bolts (14). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(3) Install brackets (8) with bolts (7) on intermediate case and torque 36 to 40 lb.in. (4.0-4.6 Nm).

(4) Engage lugs on compressor inlet vane (15) with brackets (8) and turn vane to locking position with core-stator holder (PWC40724). Install six tab washers (16), six bolts (17) and torque 65 to 85 lb.in. (7.5-9.5 Nm).

(5) Lock six tab washers (16).

10. LP Shaft and No. 1 Bearing Housing

A. Removal (Ref. Fig. 406)

(1) Disconnect N1 speed probe wiring harness from N1/T4.5 terminal box (Ref. 77-20-01).

(2) Disconnect No. 4 bearing pressure and scavenge oil tubes from exhaust case (Ref. 79-20-03 and 79-20-04).

(3) Disconnect emergency fuel shut-off cable (Ref. 73-10-05).

(4) Disconnect and remove T4.5 "IN" wiring harness connections from N1/T4.5 terminal box (Ref. 77-20-01).

(5) Remove exhaust case(Ref. 72-50-03).

(6) Remove LP turbine module (Ref. 72-50-02).

(7) Install protector (PWC43250) on rear end of LP shaft.

(8) Remove compressor inlet cone (Ref. Para. A.).

(9) Remove low compressor tie rod (Ref. Para. A.).

CAUTION: MATERIAL OF FAN ASSEMBLY IS TITANIUM. HANDLE WITH EXTREME CARE USING CLEAN GLOVES. SCRATCHES, NICKS OR ABRASIONS MUST NOT OCCUR.

(10) Remove fan balancing assembly (Ref. Para. A.).

(11) Install sleeve spacer (3) (PWC60758) and secure with fan retaining nut (2), handtight.

(12) Remove 12 nuts (6) and bolts (4) from No. 1 bearing housing (5).

(13) Install three jacking screws (PWC32396-100) in No. 1 bearing housing jacking inserts.

CAUTION: DO NOT DAMAGE CARBON SEALS IN INTERSHAFT SEAL HOUSING.

(14) Carefully withdraw LP shaft and No. 1 bearing housing (1) together by evenly turning jacking screws and pulling LP shaft and housing assembly from engine.

(15) Secure two halves of No. 1 bearing housing together using two slave nuts and bolts.

(16) Discard preformed packing (8).

(17) Remove transfer tube (11) (Ref. Sht. 2) and discard preformed packings (10).

B. Installation (Ref. Fig. 406)

(1) Install protector (PWC43250) on the rear of LP shaft (1).

(2) Lubricate and install new preformed packing (8) on No. 1 bearing housing (5).

(3) Lubricate and install two new preformed packings (10) on oil transfer tube (11).

(4) Push transfer tube (11) into No. 1 bearing oil nozzle assembly (12).

(5) Remove slave nuts and bolts from No. 1 bearing housing.

CAUTION: DO NOT DAMAGE CARBON SEALS IN INTERSHAFT SEAL HOUSING.

(6) Make sure oil transfer tube (11) is aligned with No. 1 bearing oil nozzle (12) and oil transfer tube housing (9) and insert LP shaft assembly and bearing housing assembly into engine.

(7) Secure No. 1 bearing housing assembly (5) to No. 1 bearing support with 12 bolts (4) and nuts (6). Torque 27 to 30 lb.in. (3.0-3.4 Nm.) using a star tightening pattern.

(8) Remove fan retaining nut (2) and sleeve spacer (3).

(9) Install fan balancing assembly (Ref. Para. B.).

(10) Install compressor inlet cone (Ref. Para. B.).

(11) Install low compressor tie rod (Ref. Para. B.).

(12) Remove protector (PWC43250) from rear end of LP shaft.

(13) Install LP turbine module (Ref. 72-50-02).

(14) Install exhaust case (Ref. 72-50-03).

11. Fits, Clearances and Torque Loadings

A. General

The following pages provide the fits and clearances, torques, spring pressures, special assembly, and backlash checks.

All tables have metric equivalents given in parentheses either beside or below the imperial measurements.

For all tables, the indicated REF. NO. can be found on the Figure following the last table.

B. Dimensional Checks

The DIMENSIONS FOR REF. column indicates minimum and maximum manufacturing dimensions of two mating parts. These dimensions are provided for information only.

The LIMITS column indicates the desired minimum and maximum fits and clearances between new parts, and also the allowable limit to which these parts may wear before replacement is necessary.

The letter T indicates a tight fit; L or no letter, a loose fit.

BY SELECTION means parts must be matched by selection to provide a required fit.

FIT TO means a fitting operation may be required at assembly to obtain the required fit.

An asterisk (*) indicates part(s) should be replaced if any looseness is evident.

Unless otherwise stated, all fits are diametrical. Spline fits are calculated from chordal dimensions.

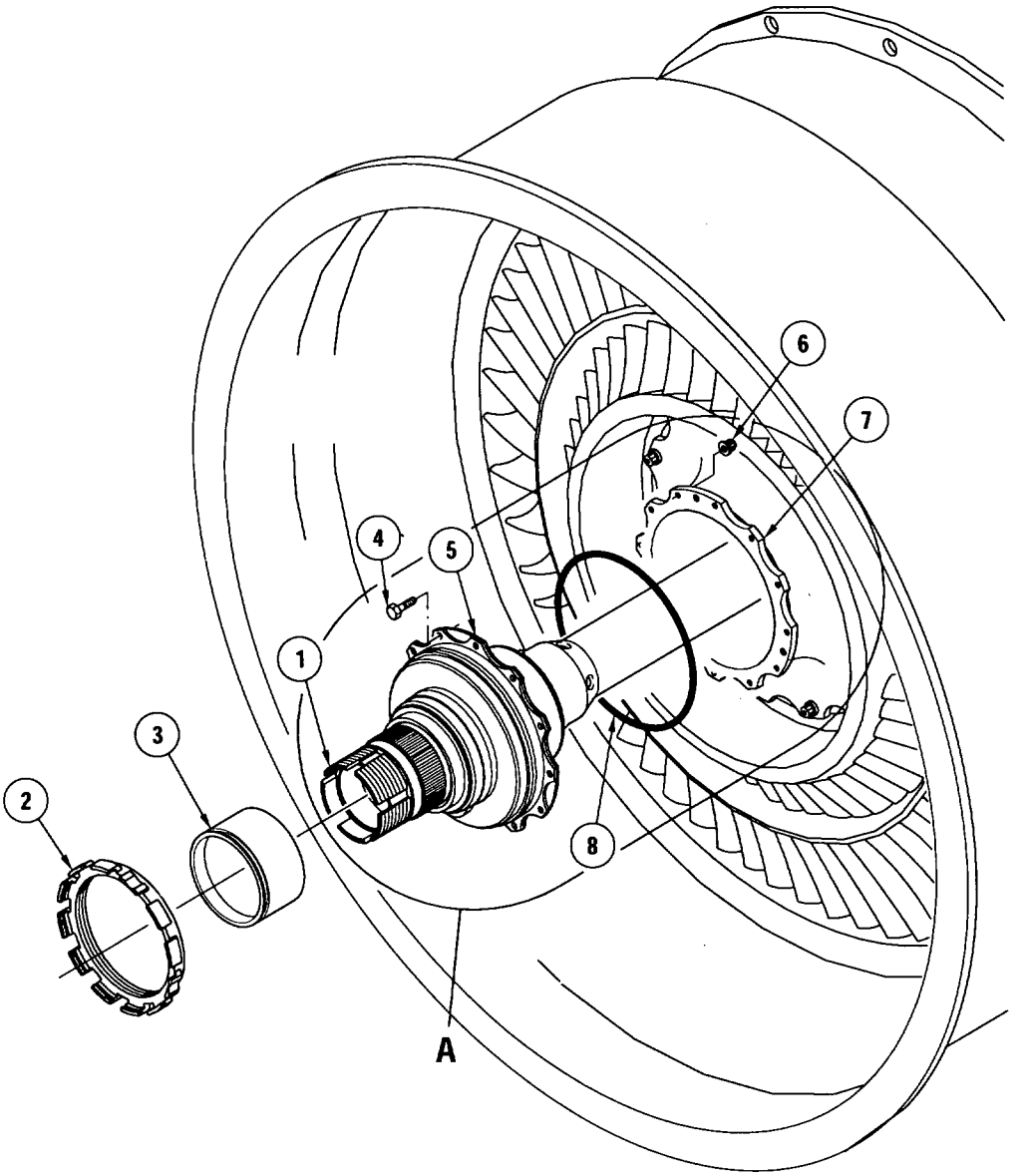
C. Torque Limits

Unless otherwise stated, apply thread lubricant to all parts that are to be torque-loaded.

Use engine lubricating oil or equivalent, unless otherwise specified.

Where torque limits for castle nuts are provided in the MINIMUM column only, these nuts should be tightened to the designated torque and then further tightened, if necessary, to properly align the locking slots and holes.

Where MINIMUM and MAXIMUM values are given, the alignment of the locking slot must be obtained without loosening the nut and without exceeding the maximum limit. If this is not possible, back-off the nut half a turn, then retighten. If alignment cannot be accomplished, select another nut.

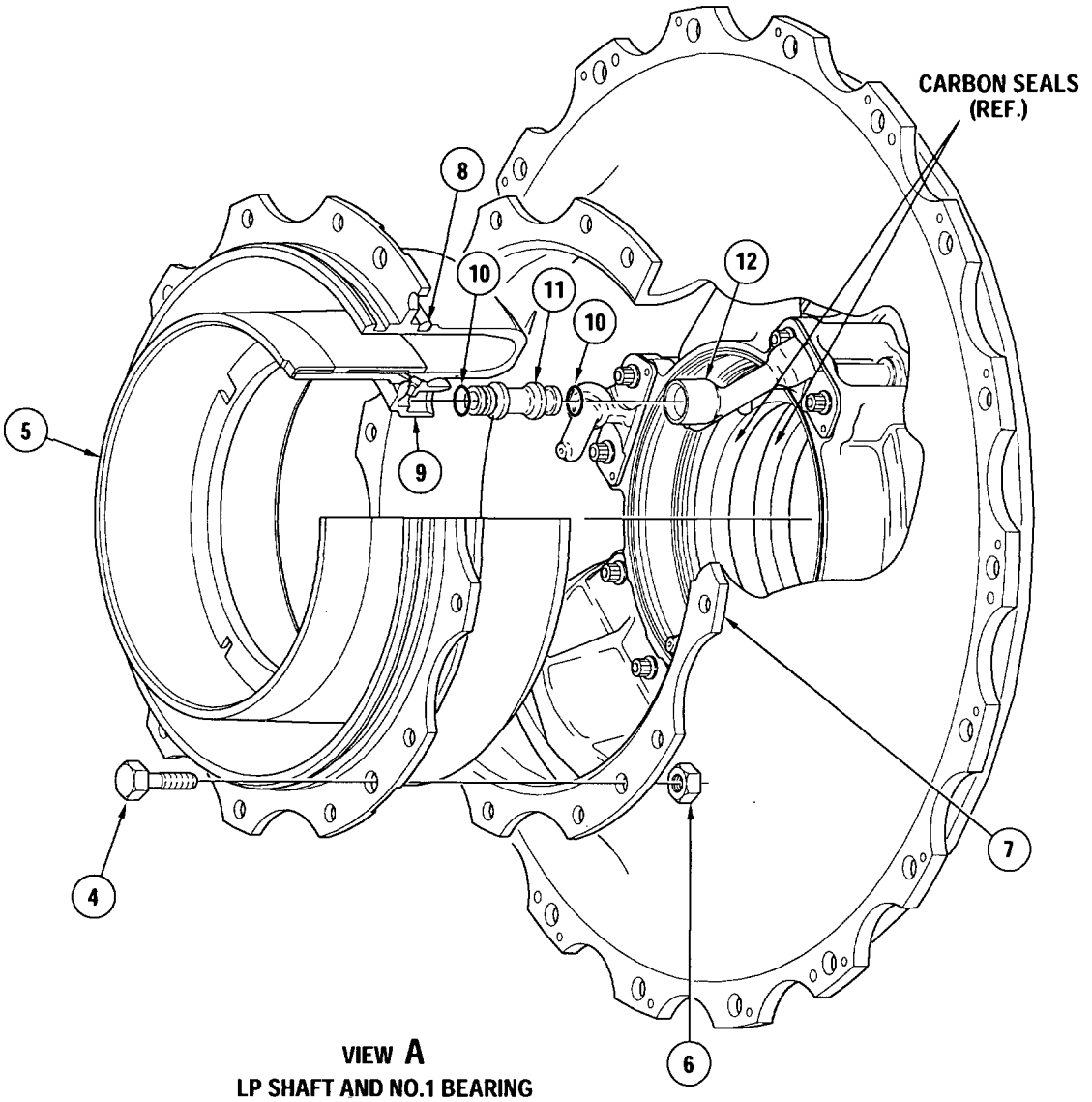


C62311

Removal/Installation of LP Shaft and No. 1 Bearing Housing
Figure 406 (Sheet 1 of 2)

Key to Figure 406

1. LP Shaft and No. 1 Bearing Housing
2. Fan Retaining Nut
3. Sleeve Spacer (PWC60758)
4. Bolt
5. No. 1 Bearing Housing
6. Nut
7. No. 1 Bearing Support (Ref.)
8. Preformed Packing
9. Oil Transfer Tube Housing
10. Preformed Packing
11. Transfer Tube
12. No. 1 Bearing Oil Nozzle (Ref.)



C62312

Removal/Installation of LP Shaft and No. 1 Bearing Housing
Figure 406 (Sheet 2)

Torque requirements for interference fit applications, such as studs, may be obtained with or without lubrication, unless otherwise specified.

TABLE 401, Fits and Clearances

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1003	Tie Rod, Low Compressor	2.392 (60.757)	2.396 (60.858)	0.006 (0.152)	0.014 (0.356)	
	Shaft, Low Compressor	2.402 (61.011)	2.406 (61.112)			
1004	Ring, Blade Retaining, Front (Axial Clearance)			0.000 (0.000)	0.002 (0.051)	
1006	Pre-SB24279 Baffle, Compressor Inlet Cone	8.5220 (216.459)	8.5232 (216.489)	0.0002T (0.005T)	0.0032T (0.081T)	
	Cone, Compressor Inlet	8.5200 (216.408)	8.5218 (216.454)			
1006	Post-SB24279 Not Applicable					
1027	Collar Segment, Blade Retaining	11.548 (293.319)	11.549 (293.345)	0.000 (0.000)	0.003 (0.076)	
	Ring, Blade Retaining, Rear	11.549 (293.345)	11.551 (293.395)			
1028	Hub, Fan	8.7522 (222.306)	8.7532 (222.331)	0.0002T (0.005T)	0.0032T (0.081T)	
	Ring, Blade Retaining, Front	8.750 (222.250)	8.752 (222.301)			
1029	Hub, Fan	11.1422 (283.012)	11.1432 (283.037)	0.0002T (0.005T)	0.0032T (0.081T)	
	Ring, Blade Retaining, Rear	11.140 (282.956)	11.142 (283.007)			

TABLE 401, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1244	Case, Intermediate	31.508 (800.303)	31.512 (800.405)	0.002T (0.051T)	0.010T (0.254T)	
	Case, Fan, Assy of	31.502 (800.151)	31.506 (800.252)			
1245	Case, Intermediate	31.204 (792.582)	31.208 (792.683)	0.002 (0.051)	0.010T (0.254T)	
	Shroud, Fan Exit Vane, Outer	31.198 (792.429)	31.206 (792.632)			
1246	Case, Fan	30.512 (775.005)	30.516 (775.106)	0.004 (0.102)	0.016 (0.406)	
	Shroud, Fan Exit Vane, Outer	30.520 (775.208)	30.528 (775.411)			
1247	Case, Intermediate	20.598 (523.189)	20.600 (523.240)	0.006 (0.152)	0.004T (0.102T)	
	Shroud, Fan Exit Vane, Inner	20.596 (523.138)	20.604 (523.342)			
1256	Blade, Fan (LE Radial Tip Clc For New Abradable Material - See Note)			0.0165 (0.419)	0.0295 (0.749)	

NOTE: Fan blade tip clearance can exceed REF. NO. 1256 for previously run engines but must not exceed 0.050 inch. Beyond this limit, return case to P&WC.

TABLE 402, Torque and Stretch

REF. NO.	Name	Limits Min.	Limits Max.
1701	Bolt, Compressor Inlet Cone	110 (12.43) See NOTE	120 (13.56)

TABLE 402, Torque and Stretch (Cont'd)

REF. NO.	Name	Limits Min.	Limits Max.
1702	Nut - Retaining, Fan Hub (Pre-SB24202)		

WARNING: MAKE SURE THAT THE FAN SEATING TORQUING PROCEDURE USING SLAVE PARTS REF. PARA. B. HAS BEEN COMPLETED.

(1) Match mark cupwasher using silver pencil (PWC05-018) to detect movement during torquing.

(2) Tighten nut 1140 to 1740 lb.in. (128.8 to 196.5 Nm).

(3) Establish common reference points between the nut and mating parts using a silver pencil (PWC05-018).

CAUTION: DO NOT EXCEED 1000 lb. ft. (1365 Nm) TORQUE.

(4) Turn nut thru angle of 37 to 40 degrees.

(5) Loosen nut to 0.0 lb.in. (0.0 Nm).

(6) Tighten nut 1140 to 1740 lb.in. (128.8 to 196.5 Nm).

CAUTION: DO NOT EXCEED 1000 lb. ft. (1365 Nm) TORQUE.

(7) If the nut reference point is in line with mating part reference point or beyond it within 4 degrees maximum it is within limits. Apply final torque by turning the nut thru an angle of 37 to 40 degrees.

CAUTION: ANTIGALLING COMPOUND MUST BE COMPLETELY REMOVED FROM THE THREADS AND CONTACT FACE OF NUT THEN RE-APPLIED TO THE SAME AREAS IF THE NUT IS REMOVED FOR ANY REASON.

(8) If nut reference points are not within limits, repeat steps (3), (4), (5) and (6) in order, until reference points are within limits then apply final angle of turn per step (7).

1702 Nut - Retaining, Fan Hub (Post-SB24202 and Pre-SB24597)

WARNING: MAKE SURE THAT THE FAN SEATING TORQUING PROCEDURE USING SLAVE PARTS REF. PARA. B. HAS BEEN COMPLETED.

(1) Match mark cupwasher using silver pencil (PWC05-018) to detect movement during torquing.

(2) Tighten nut 1140 to 1860 lb.in. (128.8 to 210.15 Nm).

(3) Establish common reference points between the nut and mating parts using a silver pencil (PWC05-018).

TABLE 402, Torque and Stretch (Cont'd)

REF. NO.	Name	Limits Min.	Limits Max.

CAUTION: DO NOT EXCEED 1000 lb. ft. (1365 Nm) TORQUE.

(4) Turn nut thru angle of 40 to 43 degrees.

(5) Loosen nut 0.0 lb.in. (0.0 Nm).

(6) Tighten nut 1140 to 1860 lb.in. (128.8 to 210.15 Nm).

CAUTION: DO NOT EXCEED 1000 lb. ft. (1365 Nm) TORQUE.

(7) If the nut reference point is in line with mating part reference point or beyond it within 4 degrees maximum it is within limits. Apply final torque by turning the nut thru an angle of 40 to 43 degrees.

CAUTION: ANTIGALLING COMPOUND MUST BE COMPLETELY REMOVED FROM THE THREADS AND CONTACT FACE OF THE NUT THEN RE-APPLIED TO THE SAME AREAS IF THE NUT IS REMOVED FOR ANY REASON

(8) If the nut reference points are not within limits, repeat steps (3), (4), (5) and (6) in order, until reference points are within limits then apply final angle of turn per step (7).

1702 Nut - Retaining, Fan Hub (Post-SB24597)

CAUTION: SLAVE SPACER TO HAVE SIMILAR FLATNESS, PARALLELISM AND SURFACE FINISH AS CUPWASHER.

CAUTION: DO NOT EXCEED MAX. TORQUE OF 12000 LB.IN. (1356 NM).

(1) Apply lubrication compound (PWC06-004) to the thread and thrust face of nut including area "AT" and to shaft thread. Remove excessive compound wherever possible.

(2) Install slave spacer in place of cupwasher "AS" and torque nut 1200 to 1920 lb.in. (135.58 - 216.93 Nm).

(3) Turn nut thru angle of 42 to 45 degrees.

(4) Loosen nut to 0 lb.in. (0.00 Nm).

(5) Remove slave spacer, install cupwasher and match mark with silver pencil (PWC05-018) to detect rotation during torquing.

(6) Torque nut 1140 to 1860 lb.in. (128.8 - 210.15 Nm).

(7) Establish common reference points between the nut and mating parts with silver pencil (PWC05-018).

(8) Turn nut thru angle of 40 to 43 degrees.

TABLE 402, Torque and Stretch (Cont'd)

REF. NO.	Name	Limits Min.	Limits Max.
	CAUTION: UNTORQUE VALUE OF NUT MUST NOT EXCEED 14400 LB.IN. (1627 NM).		
	(9) Loosen nut 0.0 lb.in. (0.0 Nm) and repeat step (6).		
	(10) If the nut reference point is in line with mating part reference point or beyond it within 4 degrees maximum it is within limits. Apply final torque by turning the nut per step (8).		
	(11) If the nut reference points are not within limits, repeat steps (7), (8) and (9) in order, until reference points are within limits. Then perform step (10).		

TABLE 403, Spring Pressures

REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		

TABLE 404, Special Assembly Procedures

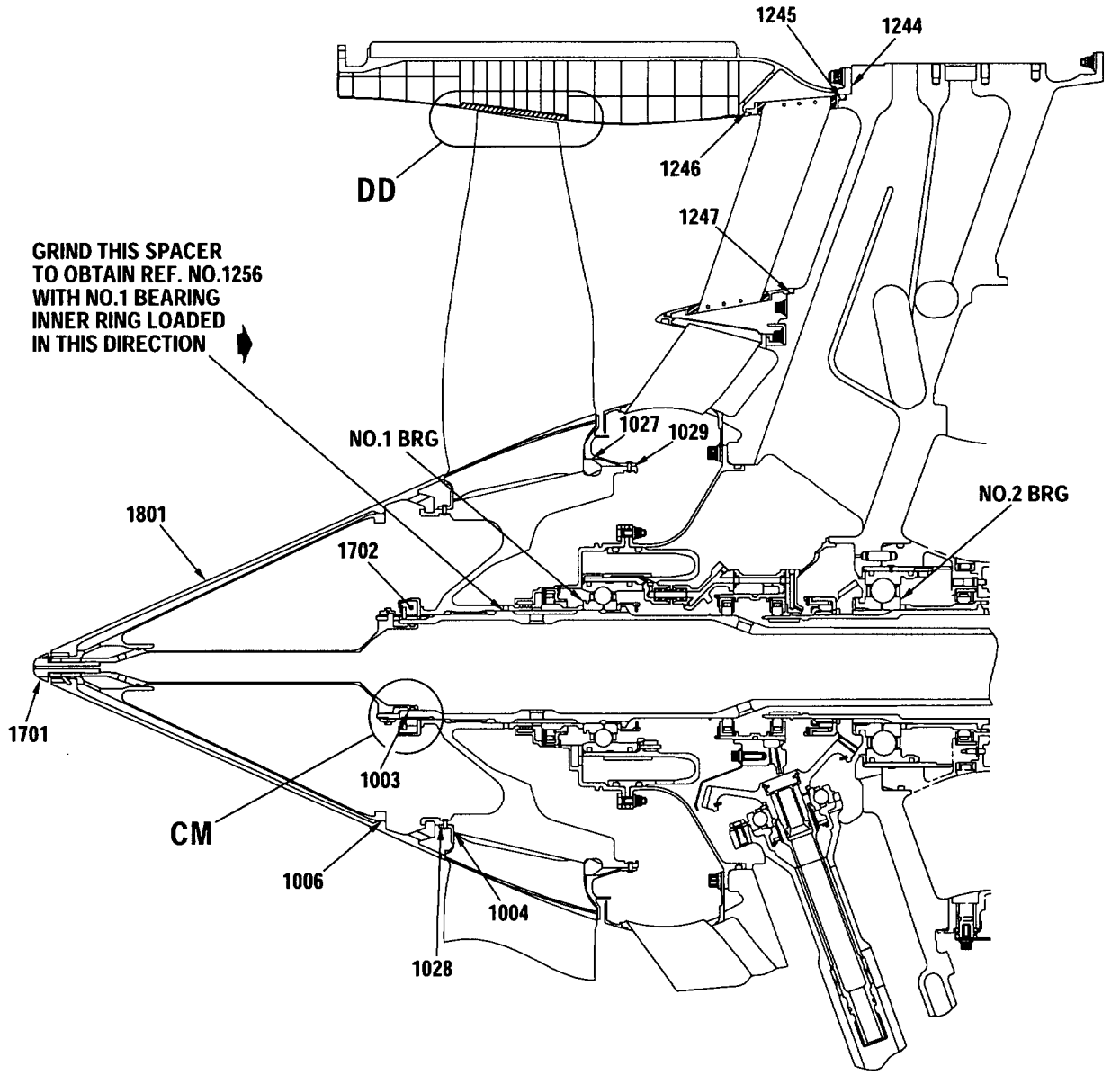
REF. NO.	Name	Limits Min.	Limits Max.
1801	Nose Cone Assembly		
	(1) Assemble tie rod onto shaft so that tangs are loaded rearward into shaft shoulder.		
	(2) Turn tie rod retaining nut on shaft until it touches tie rod, and turn back to the next locking position.		
	(3) Using puller (PWC30128-03) load tie rod forward so that tangs lock tie rod retaining nut.		
	(4) Pre-SB24355: Assemble cone assembly onto fan hub bayonet.		
	(5) Post-SB24355: Assemble cone assembly onto fan hub bayonet so the "V" marks on the fan hub assembly and compressor inlet cone line up after final assembly.		
	(6) Rotate cone assembly until drive keywashers can be inserted.		
	(7) Tighten bolt per REF. NO. 1701 to a locking position using socket (PWC43260).		

TABLE 404, Special Assembly Procedures (Cont'd)

REF. NO.	Name	Limits Min.	Limits Max.
(8)	Lock bolt by bending tabs of keywasher into two opposing slots of inlet cone bolt using a suitable drift.		

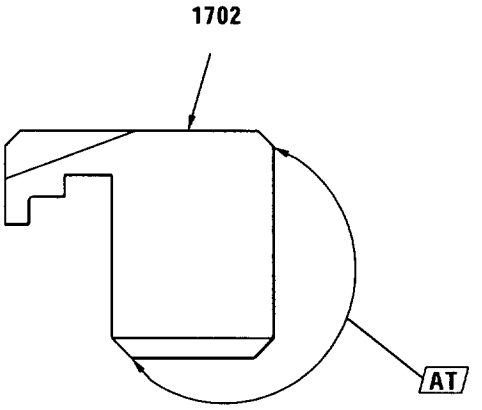
TABLE 405, Backlash

REF. NO.	Name	Limits Min.	Limits Max.
NOT APPLICABLE			

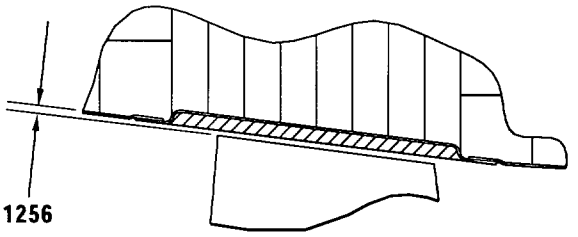


C33744A

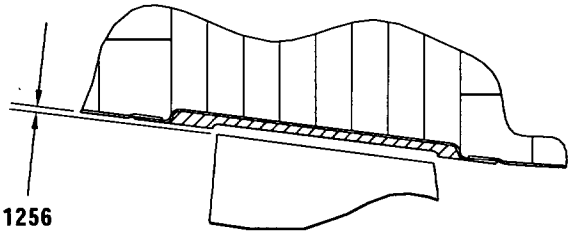
Fan Balancing Assembly - Fits and Clearances
Figure 407 (Sheet 1 of 2)



VIEW **CM**
SHOWING NUT ONLY, FOR CLARITY



VIEW **DD**
SHOWING ASSEMBLY CLEARANCE
PRIOR TO ENGINE RUN



REPEAT VIEW **DD**
SHOWING ASSEMBLY CLEARANCE
AFTER ENGINE RUN

C33749

Fan Balancing Assembly - Fits and Clearances
Figure 407 (Sheet 2)

LP COMPRESSOR - INSPECTION

1. General

   A. This section provides instructions and limits, required to perform visual inspection of the Compressor Inlet Cone, Fan Blades, Fan Case and Inlet Vane Rings.

   B. Within the following text, where the term nicks or dents is used, unless otherwise specified, blend repair limits are applicable provided at least 70 percent of original surface remains undamaged.

   C. Parts found unsuitable for further engine running should be replaced. Rejected parts should be returned to Pratt & Whitney Canada for complete inspection and possible repair/refurbishment.

2. Consumable Materials

   Not Applicable

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Compressor Inlet Cone

   A. Inspection

      (1) Check for foreign object damage and erosion.

      (2) Check for evidence of cracks. No cracks permitted.

      (3) Check for dents. A maximum of two dents permitted, provided depth is not greater than 0.100 inch and span is not greater than 1.0 inch. Dents directly adjoining each other are not acceptable.

P&WC Proprietary Information. Subject to the restrictions on the title page.

6. Fan Blades

A. Damage Limits

CAUTION: RETURN ENGINE TO AN APPROVED OVERHAUL FACILITY FOR INSPECTION IN ACCORDANCE WITH THE OVERHAUL MANUAL, IF FOREIGN OBJECT DAMAGE IS SUSPECTED. DAMAGE MUST NOT EXTEND INTO THE CORE GAS PATH.

(1) A fan with blade damage beyond the blend repair limits in Table 601 must be removed from service and sent to an approved overhaul facility for repair. If an aircraft must be flown to a facility equipped for fan removal, record the extent of blade damage and submit this information to Pratt & Whitney Canada Inc. A review of the information may permit P&WC to recommend limited engine operation for purposes of obtaining flight permission from the operator's regulatory authority.

B. Inspection

CAUTION: MATERIAL OF FAN BALANCING ASSEMBLY IS TITANIUM. HANDLE WITH EXTREME CARE USING CLEAN, LINT-FREE GLOVES.

(1) Inspect for:

(a) Cracks. No cracks permitted.

(b) Leading edge (LE) erosion. Blend LE to restore the original radius as shown on Fig. 601, Sheet 2, Detail A, if the erosion caused LE flat exceeds 0.020 inch width.

(c) Nicks and dents damage (Ref. Fig. 601 and Table 601). Blend repairs are not necessary unless damage exceeds limits as shown in Table 601.

(d) LE bend or deformation. Acceptable providing the displacement (Ref. Fig. 601, View B) of material does not exceed 0.020 inch perpendicular on the LE span and the length of the bend is less than 0.060 inch along the LE span and the bend is smooth and continuous.

(e) Fan blades with damage in excess of stated blend limits (Ref. Table 601) must be returned to an approved repair facility capable of disassembly, assembly and balancing a fan assembly.

(f) Following completion of blend repairs, an in-situ fan trim balance is recommended (Ref. 71-00-00 ADJUSTMENT/TEST).

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE 601, Nicks/Dents Fan Blade Inspection and Repair Limits

Area	Max. Damage without blending	Maximum Blend Limits			Comments
		Max. Depth	Max. Length	Min. Radius (R)	
A	Less than 0.010 inch.	0.400 inch at the tip.	1.500 inches.	Blend R 0.250 inch. Corners R 0.060 inch.	Ref. Fig. 601 for cut back. Ref. Notes 1 and 3.
B	Less than 0.010 inch.	0.150 inch.	Total for area B, C & D 2.000 inches.	Blend R 0.250 inch. Corners R 0.060 inch.	Ref. Fig. 601 for blending. Ref. Notes 2 and 3.
C	Less than 0.010 inch.	0.075 inch.	Total for area B, C & D 2.000 inches.	Blend R 0.250 inch. Corners R 0.060 inch.	Ref. Fig. 601 for blending. Ref. Notes 2 and 3.
D	Less than 0.010 inch.	0.030 inch.	Total for area B, C & D 2.000 inch.	Blend R 0.250 inch. Corners R 0.060 inch.	Ref. Fig. 601 for blending. Ref. Notes 2 and 3.
E	Less than 0.010 inch.	0.150 inch.	Total for area E & F 1.000 inch.	Blend R 0.250 inch. Corners R 0.060 inch.	Ref. Fig. 601 for blending. Ref. Notes 2 and 3.
F	Less than 0.010 inch.	0.075 inch.	Total for area E & F 1.000 inch.	Blend R 0.250 inch. Corners R 0.060 inch.	Ref. Fig. 601 for blending. Ref. Notes 2 and 3.
G	Less than 0.005 inch.				No blending permitted. Ref. Note 3.
H	Less than 0.005 inch.	0.015 inch.	Max. surface 10% of blade	Blend R 0.150 inch.	Ref. Note 3.

TABLE 601, Nicks/Dents Fan Blade Inspection and Repair Limits (Cont'd)

Area	Max. Damage without blending	Maximum Blend Limits			Comments
		Max. Depth	Max. Length	Min. Radius (R)	
NOTE: 1. a) Only two blades for each set separated by minimum six blades may be repaired to the maximum cut back limit. b) Smaller cut back repair can be applied up to eight consecutive blades. The total cut back area must not exceed the equivalent of one cut back performed to maximum limit. c) Total area of cut back repair for a set must not exceed the equivalent of two cut backs performed to the maximum limit.					
NOTE: 2. a) Only six blades for each set can be repaired to the maximum limit. b) The cumulative total of all blend repairs performed on a set must not exceed the equivalent of six blades repaired to the maximum limit. c) The maximum total blend repair length for one blade over areas B, C and D must not exceed 2.000 inches. d) The maximum total blend repair length for one blade over areas E and F must not exceed 1.000 inch.					
NOTE: 3. Scattered round bottom dents are acceptable without repair.					
NOTE: 4. Blending must be to existing contour. Leading and trailing edge radii must be restored (Ref. Fig. 601, Sheet 2).					

7. Fan Case

A. Inspection (Ref. Fig. 602)

CAUTION: FAN CASE ASSEMBLY IS A COMPOSITE MATERIAL COMPONENT WITHIN A FORGED ALUMINUM CASE. DO NOT DROP OR IMPACT IN ANY WAY. WHEN TRANSPORTING OR STORING, USE A SUITABLE CONTAINER AND ENSURE CASE IS COVERED WITH A SUITABLE PROTECTIVE PACKING (e.g. BUBBLE PACK).

(1) Visually check fan case without aid of magnification. However, magnification up to 4X may be used as an aid to evaluate observed damage.

NOTE: Definitions of damage and acceptable limits to composite areas of fan case are as specified in Tables 602, 603 and 604.

(2) Visually check forged aluminum case for:

(a) Raised metal and sharp edges. Stone to remove.

(b) Nicks, burrs, scratches and scores. Acceptable to up to 0.005 inch deep and not acceptable beyond 0.010 inch deep. Damage from 0.005 to 0.008 inch deep may be blended to a maximum depth of 0.010 inch.

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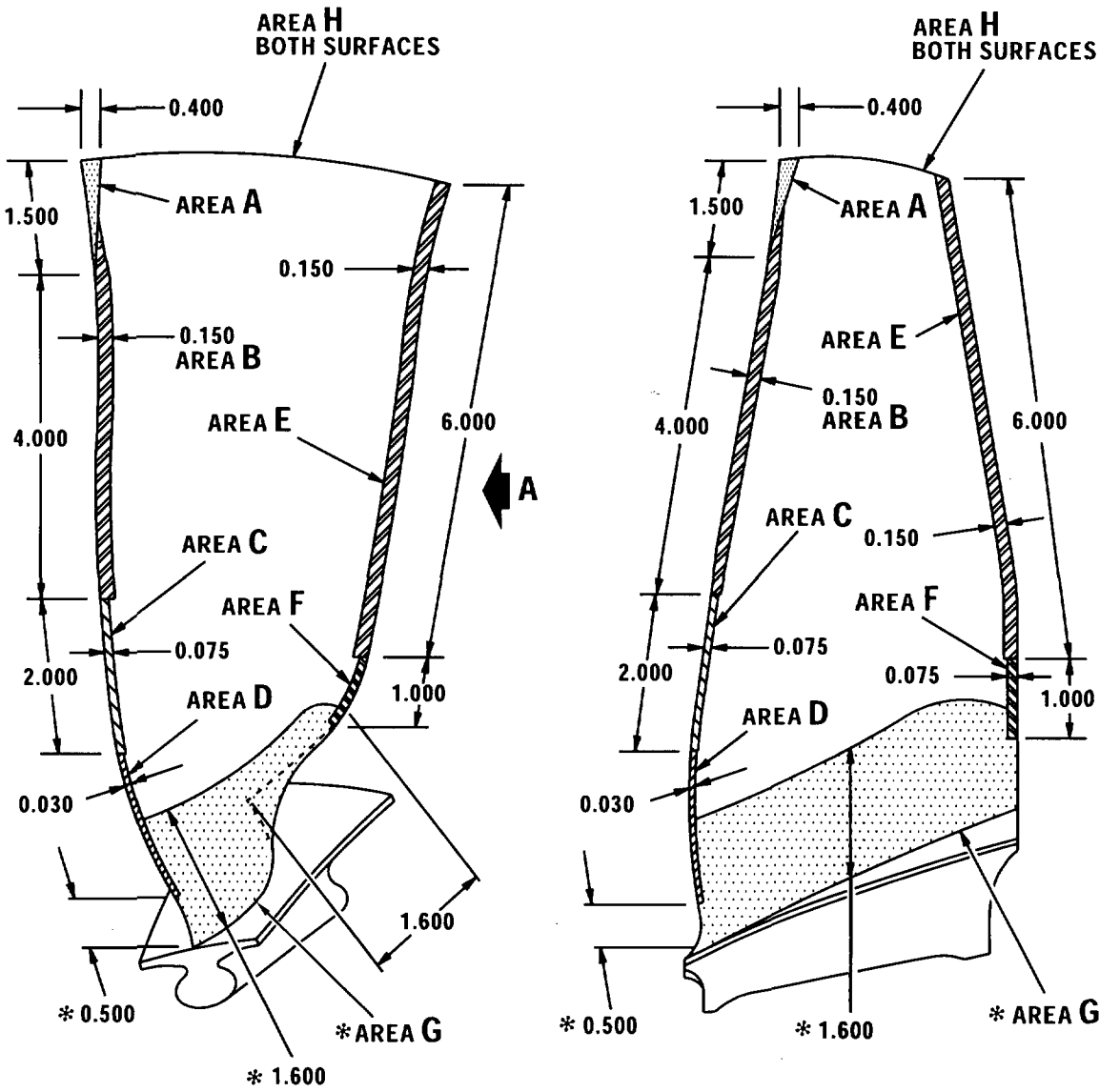
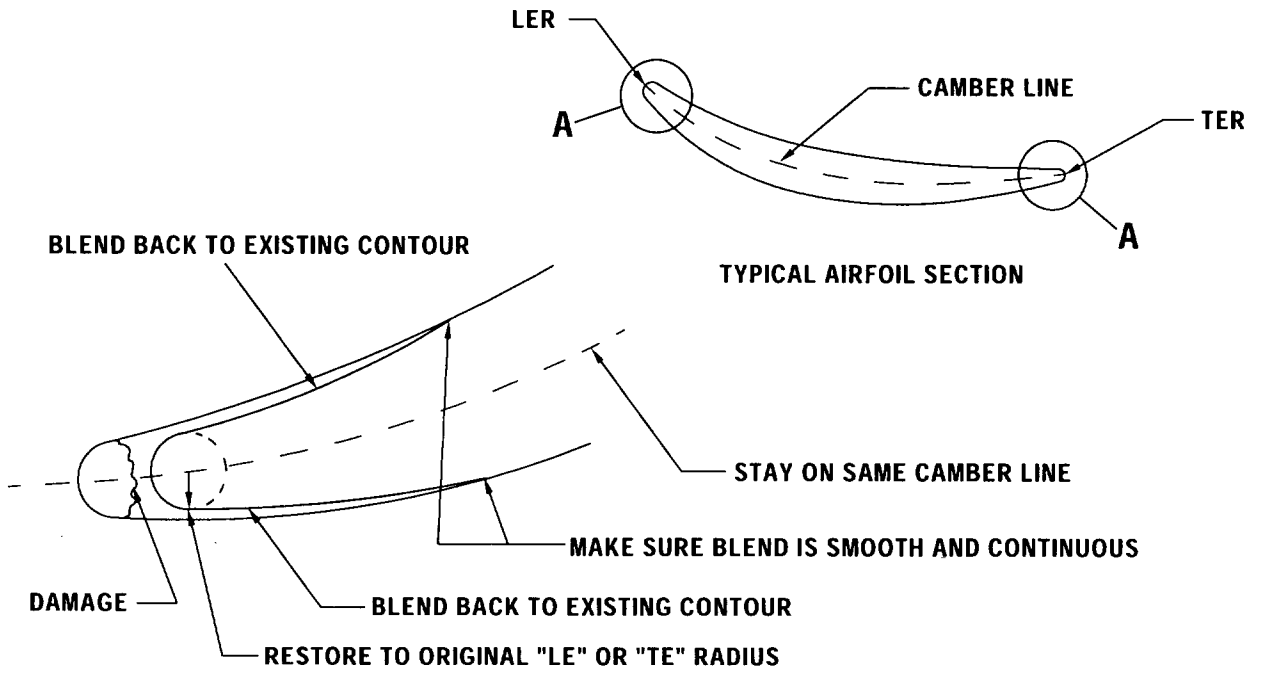


* THIS DIMENSION INCLUDES THE FILLET RADIUS

VIEW A

C30545A

Fan Blades - Inspection
Figure 601 (Sheet 1 of 2)



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Fan Blades - Inspection
Figure 601 (Sheet 2)

(c) Damage and elongation of flange holes. Elongation is acceptable to a maximum of 0.020 inch radially and 0.010 inch axially. Stone to remove raised metal and sharp edges.

(d) Cracks. No cracks are permitted.

(3) Visually check abradable lining (Area f) for (Ref. Table 602):

(a) Foreign inclusions, holes, or cracks .

(4) Visually check front and rear perforated sections (Areas g and h) for (Ref. Table 603):

NOTE: Front perforated area is aluminum alloy (AMS 4027) and rear perforated area is stainless steel (AMS 5524).

(a) Ingress of foreign debris (e.g. oil, rubber, dirt). Clean as necessary.

(b) Nicks, scratches, dents, cracks and holes in perforated areas.

(5) Visually check exterior kevlar containment wrap for (Ref. Table 604):

(a) Evidence of damage to the kevlar wrap. No evidence of fraying or cutting is permitted. Return fan case to P&WC for possible replacement of kevlar wrap.

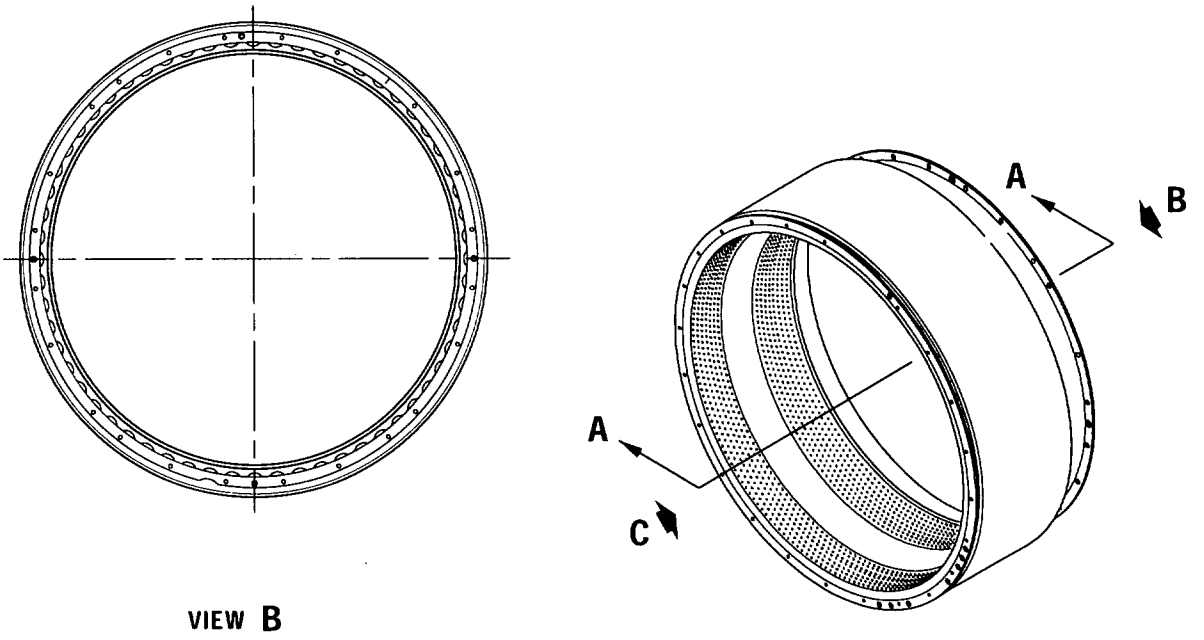
(b) Evidence of nicks, scratches or dents.

(c) Wrinkles and ripples are acceptable.

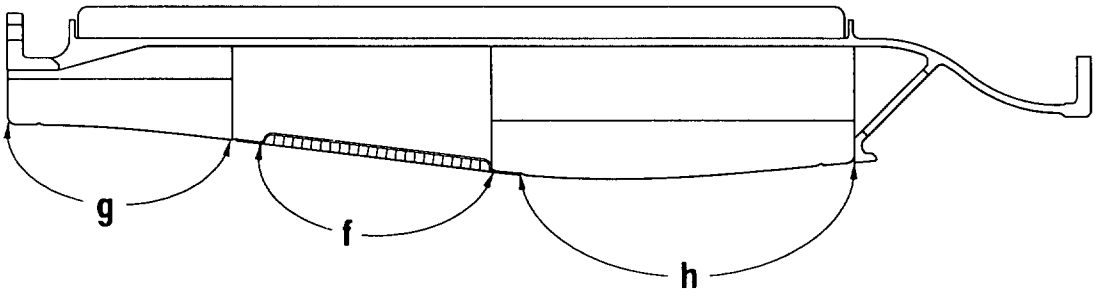
(d) Surface coating cracking, crazing is acceptable.

(6) Dimensionally check:

(a) Abradable lining for wear (Fits and Clearances, REF. NO. 1256)).



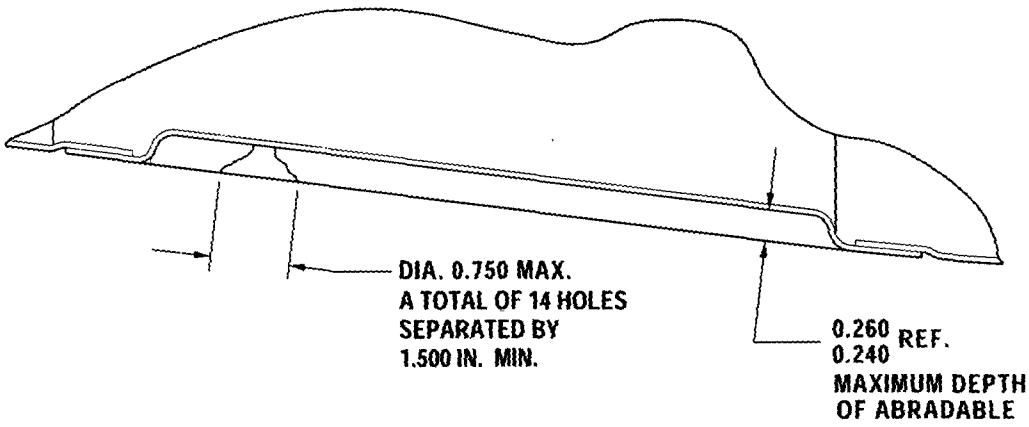
Fan Case Inspection
Figure 602 (Sheet 1 of 7)

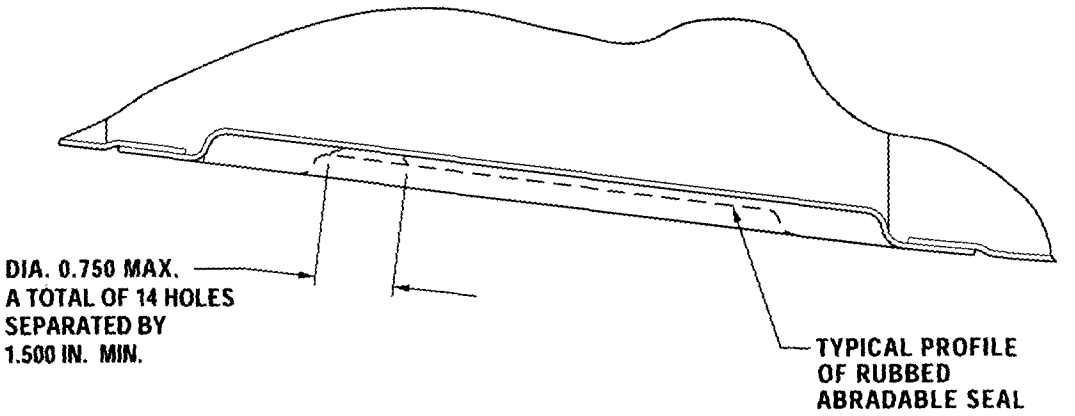


REPEAT SECTION A–A

C24858

Fan Case Inspection
Figure 602 (Sheet 2)

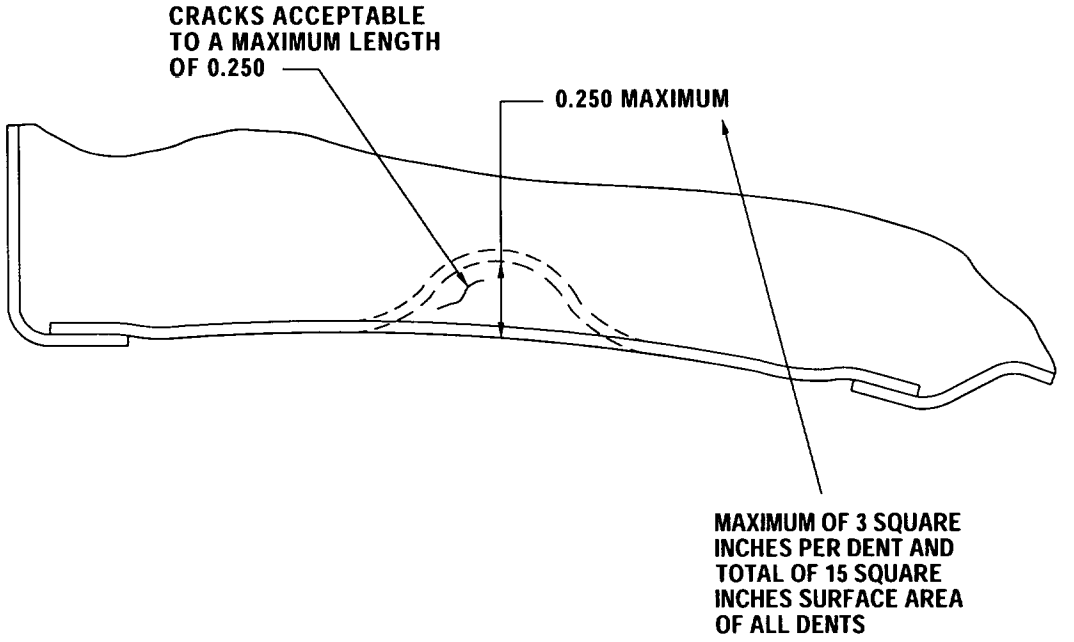




TYPICAL VIEWS SHOWING
ACCEPTABLE HOLE DAMAGE
IN ABRADABLE SEAL

C24874

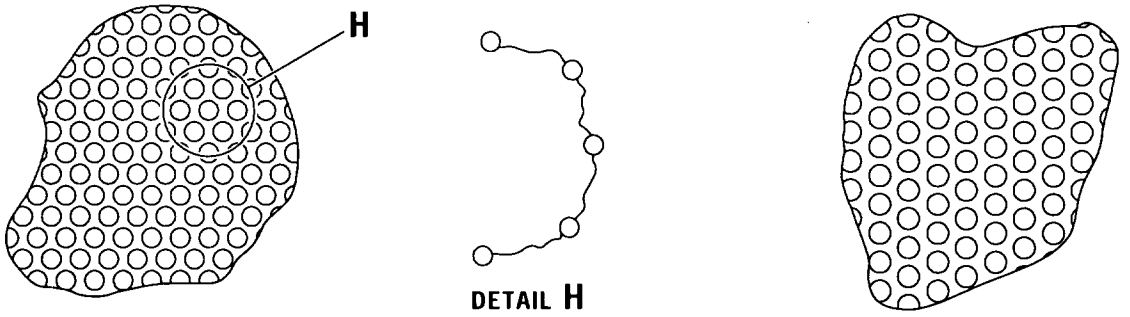
Fan Case Inspection
Figure 602 (Sheet 3)



**TYPICAL VIEW SHOWING
ACCEPTABLE DENTS IN FRONT AND REAR PERFORATE**

C24873

Fan Case Inspection
Figure 602 (Sheet 4)



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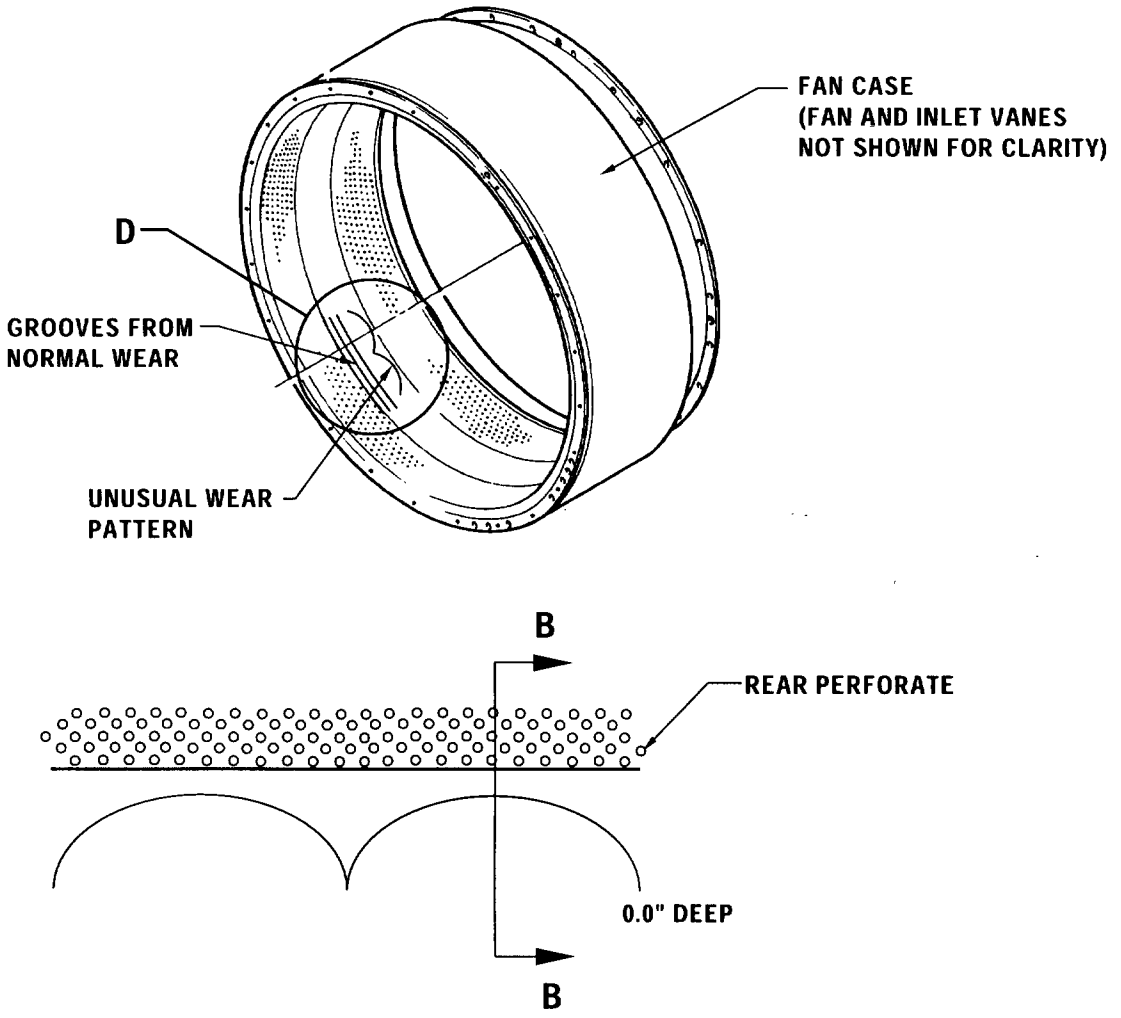
Fan Case Inspection
Figure 602 (Sheet 5)



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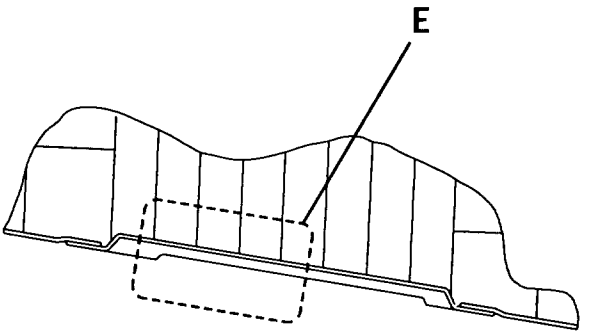
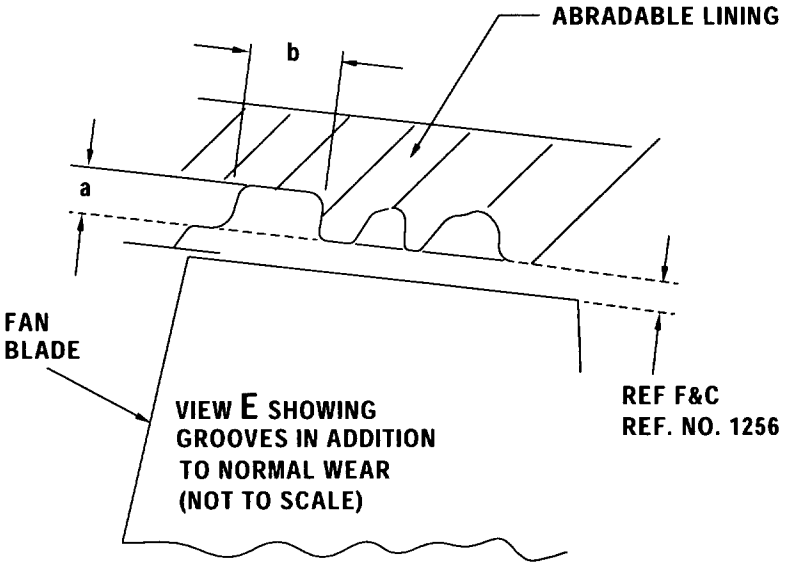
Fan Case Inspection
Figure 602 (Sheet 6)



SECTION THROUGH
FAN CASE ABRADABLE
SHOWING NORMAL WEAR



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Fan Case Inspection
Figure 602 (Sheet 7)

TABLE 602, Fan Case Abradable Lining Inspection

Damage	Definition	Acceptable Limits (Area f)
Foreign Inclusion	Particle included in a component which is foreign to material composition.	No inclusions allowed.
Hole	Missing material which results in cavity or void	Refer to Fig. 602 for acceptable limits. Maximum of 0.750 inch diameter to bottom of tray and up to maximum of 14 holes. Holes must be repaired (Ref. Repair). Tray must not be damaged.
Crack in Lining		Cracks up to 1 inch long are acceptable without repair. Cracks greater than 1 inch long but less than 6 inches must be repaired (Ref. Repair). A maximum of 8 repaired cracks, provided cracks are separated by a minimum of 3 inches. Area filled with potting compound must not exceed 2.5 square inches per crack. Multiple cracks emanating from one area and cracks joining each other are acceptable if they are repaired within the above limits.
Grooves in addition to Normal Wear	Refer to Fig. 602 Sht. 7.	Grooves up to 0.050 inch deep (dim. a) and the sum of dim. b of all grooves does not exceed 1.5 inch.
Unusual Wear Pattern Rear of Rotor Path	Refer to Fig. 602 Sht. 6.	Rubs up to 0.050 inch deep are permitted. If unusual rub pattern is present, visually inspect trailing edges of fan blade tips for cracks or tears. Damaged blades must be replaced.

TABLE 603, Fan Case Front and Rear Perforate Inspection

Damage	Definition	Limits Areas g and h
Chipping of Surface Resin Filler	Small piece broken off edge or surface.	A maximum of 20 on seams of perforate is acceptable provided chips are separated by a minimum of 2 inches and a maximum depth of damage does not exceed 1/16 inch. Remove any loose material and blend edges.
Cracking of Surface Resin Filler.	Surface cracking.	Maximum of 4 cracks allowed on the seams of the perforate panels. Maximum crack is 1.00 inch long and separated by 6 inches minimum.
Through Crack.	Perforate separated, crack extends through thickness.	Refer to Fig. 602: Maximum of 2 cracks in the perforate provided crack does not exceed 1.50 inch long and cracks are separated by a minimum of 6 inches. Cracks must be repaired (Ref. Repair).
Dent	A surface depression having rounded edges, corners or bottom. Caused by impact of a foreign object.	Refer to Fig. 602: Scattered dents not exceeding 3 square inches each, up to 0.250 inch deep. Maximum total of 15 square inches surface area for each perforate. All dents must be repaired (Ref. Repair).
Crack on Dent		Cracks acceptable to maximum length of 0.250 inch. Refer to Fig. 602.
Nicks and Scratches	Narrow shallow marks caused by movement of sharp object on surface.	Maximum of 10 to a maximum depth of 0.010 inch and a maximum length of 3 inches.
Hole	Small piece of perforate broken off.	Maximum of 4 holes, up to 0.50 inch in diameter, allowed on the perforate panels provided holes are separated by a minimum of 6 inches. Holes must be repaired (Ref. Repair).

TABLE 604, Kevlar Wrap Inspection

Damage	Definition	Acceptable Limits
Dents	Smooth bottom and round edge surface depression.	Maximum of 10 dents up to 1 square inch each.

TABLE 604, Kevlar Wrap Inspection (Cont'd)

Damage	Definition	Acceptable Limits
Nicks, Scratches or Grooves	Narrow shallow marks caused by movement of sharp object on surface.	Maximum of 5 acceptable to a maximum length of 6 inches provided damage does not penetrate kevlar wrap.

8. Inner and Outer Vane Rings

A. Fan Exit Vane Ring (Ref. Fig. 603)

(1) Vanes:

(a) Visually check for cracks. Cracks are acceptable up to a maximum of 0.100 inch long on the leading edge and 0.025 inch long on the trailing edge and may be removed by blending. Vanes with cracks over these limits , vane assembly must be replaced.

(b) Check for raised metal and sharp edges. Stone to remove.

(c) Check for nicks and dents on leading and trailing edges. Blend to remove to a maximum depth of 0.125 inch on leading edges and 0.030 inch on trailing edges.

NOTE: Leading and trailing edges must be polished after blending.

(d) Check airfoil surfaces for damages. Nicks, dents, scratches or pitting on airfoil surfaces is acceptable to a maximum depth of 0.025 inch if damage does not occur directly opposite on concave and convex surfaces of airfoil.

(2) Inner and Outer Shrouds:

(a) Check for raised metal and sharp edges. Stone to remove.

(b) Check for local surface damage. Damage is acceptable to 0.005 inch deep and not acceptable beyond 0.008 inch deep. Damage from 0.005 to 0.008 inch deep may be blended to a maximum depth of 0.010 inch.

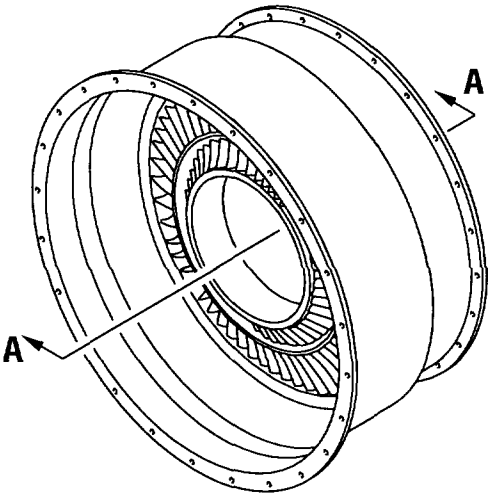
(3) All other surfaces:

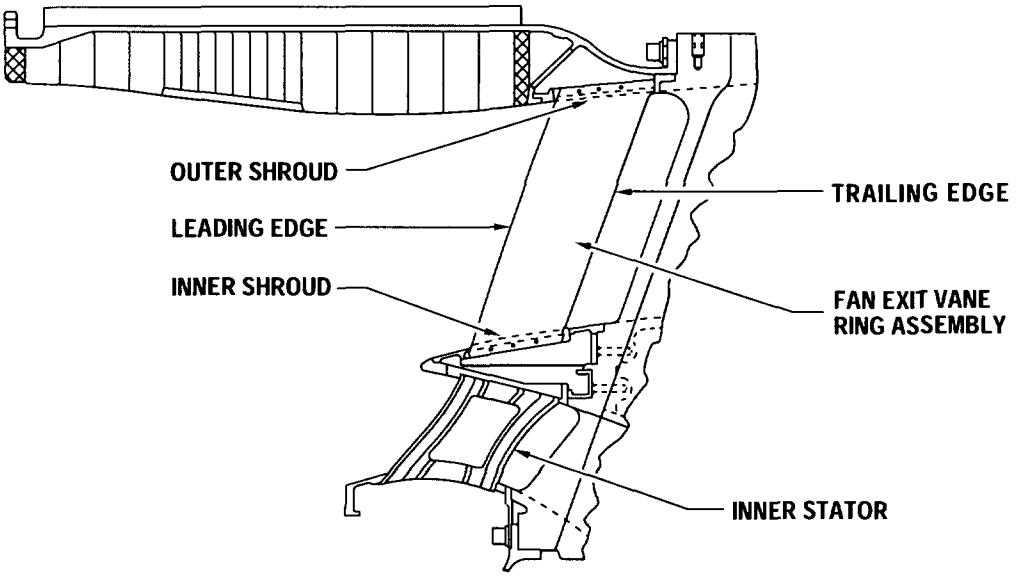
(a) Check for raised metal and sharp edges. Stone to remove.

(b) Check for local surface damage. Damage is acceptable to 0.005 inch deep and not acceptable beyond 0.008 inch deep. Damage from 0.005 to 0.008 inch deep may be blended to a maximum depth of 0.010 inch.

B. Compressor Inlet Vane Assembly (Ref. Fig. 604 and Table 605)

(1) Refer to definitions of damage and acceptable limits as specified in Table 605.

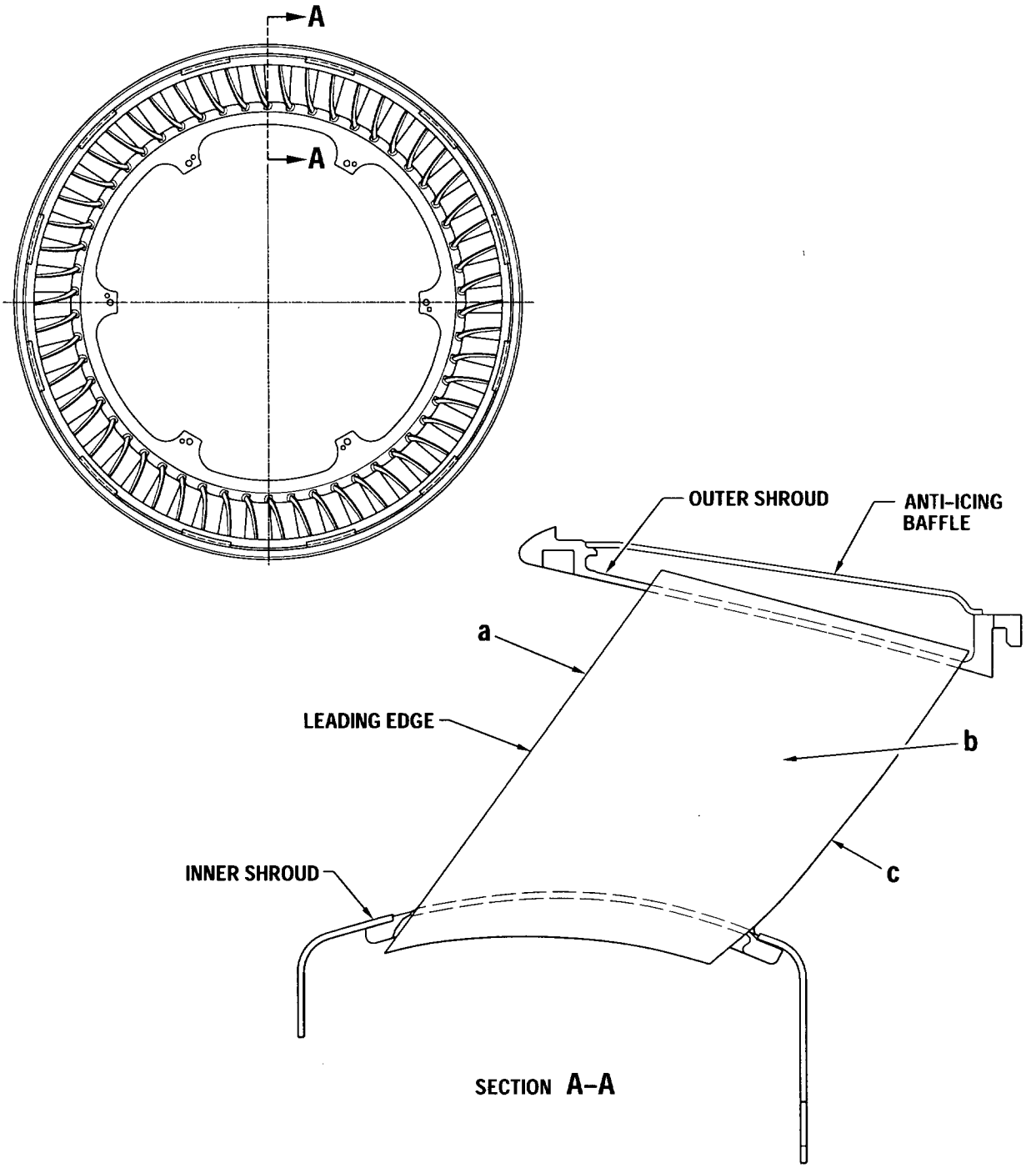




SECTION A-A

C27465

Fan Exit Vane Ring Inspection
Figure 603



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Compressor Inlet Vane Assembly
Figure 604

(2) Visual checks:

(a) Check for cracks. No cracks are permitted in the vanes. Cracks up to 0.100 inch are acceptable in the outer shroud braze fillet. Cracks in the anti-icing baffle are acceptable.

(b) Check for raised metal and sharp edges. Stone to remove.

(c) Check for nicks on leading and trailing edges. Blend to remove raised material.

NOTE: Leading and trailing edges must be polished after blending.

(d) Check for bends on the leading and trailing edges.

(e) Leading edge (LE) blends in Area a and trailing edge (TE) Area b deformation up to 0.040 inch deep and long (LE and TE span) is acceptable. Remove raised material. All LE blends must not exceed a total of 6 inches of LE spans for the complete stator assembly.

(f) A maximum of 12 dents are permitted in Area b.

TABLE 605, Compressor Inlet Vane Assembly

Location	Damage Type	Acceptable Limits	Repair Required
Areas a and c	Surface Nicks	0.005 inch deep	Stone to remove raised material.
Areas a and c	Dents	0.010 inch deep	No repair necessary.
Areas a and c	Bends	0.015 inch deep	No repair necessary.
Area b	Surface Nicks	0.005 inch deep	Stone to remove raised metal.
Area b	Dents	0.025 inch deep	No repair necessary.
Inner/Outer Shroud	Nicks/Dents	0.010 inch deep	Stone to remove raised material.
Inner/Outer Shroud	Dents	0.010 inch deep	No repair necessary.

NOTE: 1. Blends must maintain outer braze fillet radius and must not damage inner shroud potting material.

NOTE: 2. The stator vane internal passageways are required for anti-icing and must not be blocked.

9. Intermediate Case

Check for presence of corrosion and fretting marks on exposed surfaces.

NOTE: 1. Intermediate case front flanges are normally exposed after the removal of the compressor inlet stator at the Eddy Current Inspection of 1st Stage Compressor Rotor (Ref. 72-00-00 INSPECTION).

NOTE: 2. Surfaces ZZ, YY and XX are coated with a corrosion resistant epoxy: dark brown of beige color. Epoxy paint (silver color) is only present in gas path and external surfaces.

A. Inspection of Front Flanges (Ref. Fig. 605)

(1) Check for presence of corrosion and fretting marks on exposed surfaces as follows:

(a) Corrosion (grey/silver/yellow discoloration) is allowed on the entire surfaces YY and ZZ.

(b) Material displacement in the form of pitting and gouges is acceptable up to .030 inch deep, all around surface YY and ZZ.

(c) Corrosion (grey/silver/yellow discoloration) is allowed on a maximum of 30% of the entire surface XX. Pitting and gouges on the corroded surface XX should not exceed .030 inch in depth.

NOTE: 1. Intermediate case front flanges are normally exposed after the removal of the compressor inlet stator at the Eddy Current Inspection of 1st Stage Compressor Rotor (Ref. 72-00-00 INSPECTION).

NOTE: 2. Surfaces ZZ, YY and XX are coated with a corrosion resistant epoxy: dark brown or beige color. Epoxy paint (silver color) is only present in gas path and external surfaces.

B. Inspection of Gas Path Surfaces

(1) Isolated corrosion pitting up to .100 inch in diameter and .030 inch deep is acceptable.

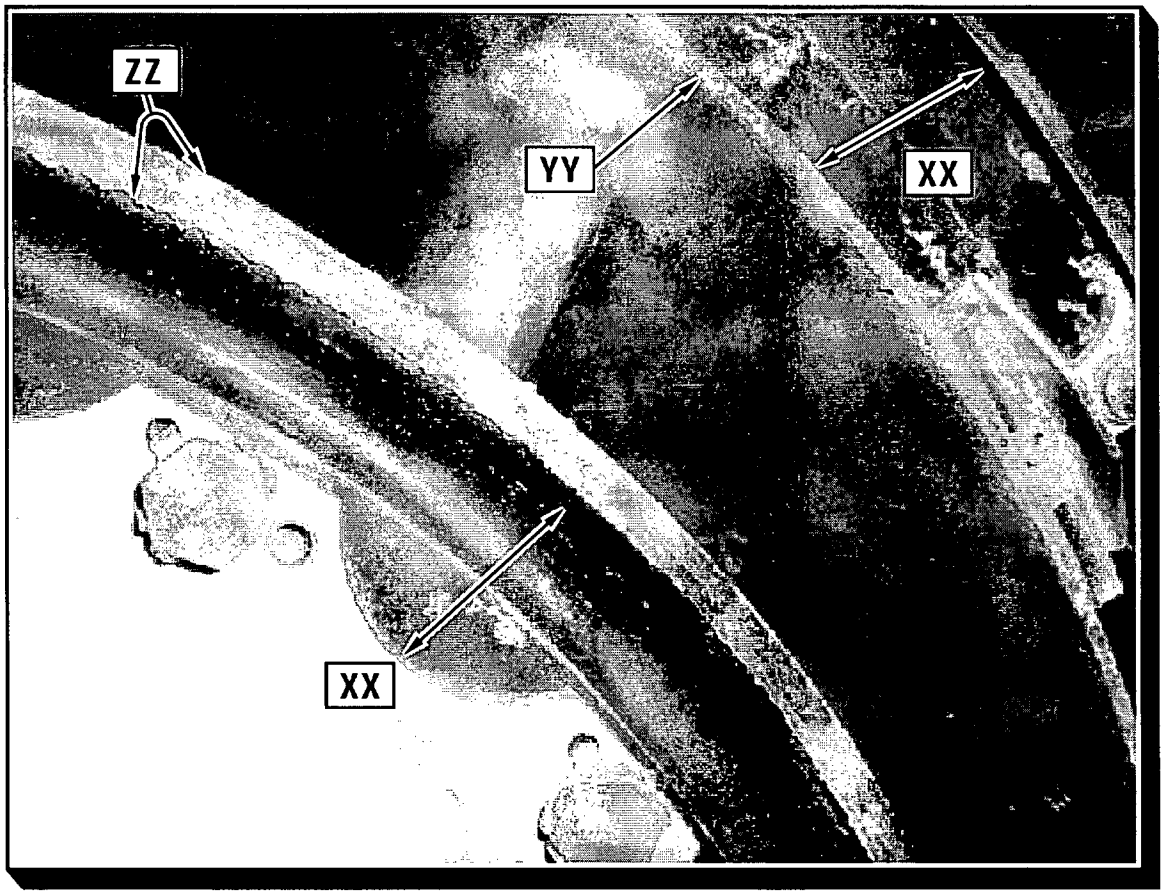
(2) Groups of corrosion pitting covering a surface of less than 1.000 inch in diameter to a .030 inches maximum in depth, are acceptable.

(3) Area with loss of epoxy silver paint of less than 1.000 inches long by 1 .000 inches wide is acceptable. These surfaces are normally free of pitting i.e. dark grey primer is still present. If pitting is present within the surface where epoxy silver paint is absent, refer to paragraph (1) and (2) above for limits of the pitting.

(4) Unlimited number of blisters without bare metal exposure is allowed.

(5) Unlimited number of grey or silver pitting mark of less than .030 inch in diameter is allowed.

NOTE: If the corrosion exceeds the limits above, it is recommended to sent the intermediate case to an overhaul facility for a complete refurbishment.



ORIGINAL
As Received By
ATP

C135620

Front Flanges Inspection
Figure 605

LP COMPRESSOR - REPAIR

1. General

   A. This section provides instructions for repairing LP Compressor components.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to CONSUMABLE MATERIALS for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC05-064	Solution, Anodize
PWC05-069	Tape, Pressure Sensitive Adhesive
PWC05-184	Compound, Potting
PWC05-197	Acid, Chromic
PWC07-011	Varnish, Air-Dry
PWC07-014	Varnish, Phenolic Resin
PWC08-016	Paste, Adhesive
PWC09-017	Adhesive/Sealant, Silicone Rubber
PWC11-014	Alcohol, Isopropyl
PWC11-022	Solvent, Cleaning

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Fan Blades

   A. Blend Repairs

      WARNING: MATERIAL OF FAN BLADES IS TITANIUM. AN ACCUMULATION OF TITANIUM DUST IS A FIRE HAZARD. CLEAN UP TITANIUM DUST ON COMPLETION OF REPAIR, DO NOT ALLOW DUST TO ACCUMULATE ON CLOTHING.

      CAUTION: REFER TO CHAPTER 70-00-00, INSPECTION AND REPAIR FOR INFORMATION ABOUT BLENDING ROTATING COMPONENTS.

      (1) Fan blades may be repaired if damage is not in excess of limits (Ref. Inspection).

      (2) Mask surfaces adjoining damaged areas using pressure sensitive tape (PWC05-069).

(3) Blend out nicks, scratches, pits and sharp edges using small hand files and stones. Finish blend using fine stones to ensure surface finish is restored to that of surrounding surface.

(4) Make sure original leading edge radius is maintained after blending.

(5) Remove pressure sensitive tape and clean off any residual adhesive using alcohol (PWC11-014).

6. Fan Case

A. Repair of Cracks or Holes in Abradable Lining

(1) Clean affected area f (Ref. Inspection) of contaminants or debris by scraping or sanding. Do not flush affected area with solvents as this tends to draw oil/grease into repair area.

NOTE: Abradable material is pale blue in color. Contaminant (black residue) removal is obvious when original color is obtained.

(2) Blow off affected area with clean, oil free compressed air or nitrogen.

(3) Mix EC-3524 B/A (PWC05-184) per following parts by weight (pbw) requirements. Weigh each material to the nearest gram of the specified amount. Mix enough to fill the repair area(s).

Base (Blue):	100 pbw
Accelerator (White):	94 pbw

(4) Mix in a plastic or metal container using a plastic spatula, and to a uniform pale blue color.

(5) Spread potting compound into repair area using a straight edge spatula. Make sure material completely bonds to the repair surface by working the material into the repair area until it darkens and moistens the existing surrounding material.

NOTE: Adequate bond will not occur if the potting compound is not worked into the repair area until it darkens and moistens the existing cured material surrounding the repaired area.

(6) Make sure potting material is flush with adjacent surfaces, to maintain gas path profile.

(7) Allow the repaired material to cure at room temperature 21°C (70°F) for 16 hours or cure at 66°C (150°F) for 2 hours.

(8) Sand finish excess material using 400 grit to return to original gas path profile.

B. Line Maintenance Repair of Delamination of Abradable Lining

CAUTION: DO NOT DRILL INTO STAINLESS STEEL SHELL OF FAN CASE.

(1) Drill several holes 1/8 inch in diameter, 1 inch apart, through delaminated section. The holes must be not less than 1/2 inch from the leading edge of the abradable lining.

(2) Inject silicone rubber compound (PWC09-017) into holes.

(3) Apply light pressure to abradable to evenly spread compound under abradable.

(4) Remove any excess material from surface of abradable.

(5) Make sure holes are completely filled with silicone rubber compound.

(6) Cure to manufacturer's instructions.

C. Heavy Maintenance Repair of Delamination of Abradable Lining

(1) Remove delaminated piece of abradable material.

(2) Repair abradable in accordance with repair procedure "Repair of Cracks or Holes in Abradable Lining" (using potting compound PWC05-184).

D. Repair of Cracks or Holes in Perforate Liner

(1) Flush clean affected area with Methyl-ethyl-ketone (PWC11-022). Air dry for 30 minutes minimum at room temperature.

CAUTION: THE EA934NA MIXTURE MUST BE USED WITHIN 40 MINUTES AFTER MIXING.

(2) Mix EA934 NA (PWC08-016) per the following parts by weight (pbw) requirements. Weigh each material to the nearest gram of the specified amount. Mix enough to fill the repair area(s). Mix in a plastic container or metal container using a plastic spatula.

Part A:	100 pbw
Part B:	33 pbw

CAUTION: DO NOT BLOCK DRAIN CHANNEL AT BOTTOM DEAD CENTER OF CASE WHEN FILLING CRACKS AND DENTS IN PERFORATE.

(3) Fill a syringe with a suitable quantity of EA934NA mixture and inject repair area.

(4) Inject the damaged area and the adjacent cells surrounding the damaged area.

(5) Wipe excess mixture from perforated liner surface.

(6) Allow 5-7 days at room temperature for full cure or 2-3 hours at 66°C (150°F) temperature using hot air gun.

(7) Sand finish repaired area to ensure smooth and burr free surface using 400 grit sand paper.

(8) Touch up any sanded perforate in Area g (Ref. Inspection) using anodize solution (PWC05-064).

7. Intermediate Case Assembly

A. Repair of Corrosion or Pitting on Mount Pads and External Surfaces (Ref. Fig. 801)

(1) Corrosion or pitting to 0.030 inch deep on mount pads or to 0.020 inch deep on other external surfaces with local pitting 0.050 inch deep max. can be repaired.

(2) Remove surface corrosion on pad recess with abrasive paper, wire brush or crocus cloth. Maintain radius. No sharp edges or raised material.

(3) Touch-up bare metal of intermediate case (Ref. Ch. 70-00-00, REPAIR).

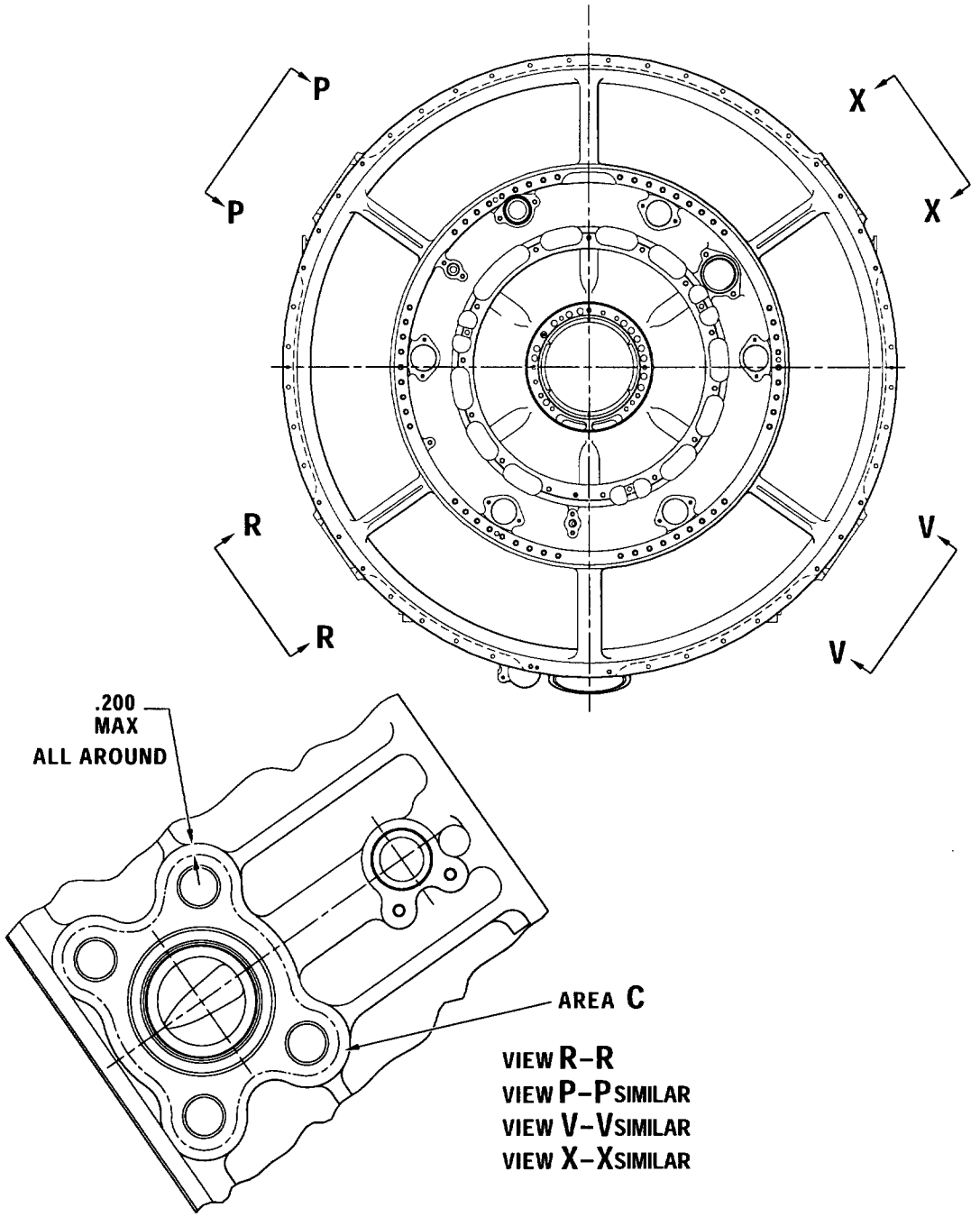
(4) Apply varnish (PWC07-011) or (PWC07-014).

8. LP Compressor Shaft

A. Removal of Corrosion on the LP Compressor Shaft Internal Bore (Ref. Fig. 802)

CAUTION: DO NOT TOUCH THE PAINTED SURFACES OF THE LP COMPRESSOR SHAFT WITH EMERY CLOTH.

(1) Remove the corrosion on the internal diameter (area A) of the LP compressor shaft with an emery cloth. The internal diameter B must be 2.405 inches maximum after the removal of corrosion. Pitting to a maximum depth of 0.10 is acceptable.



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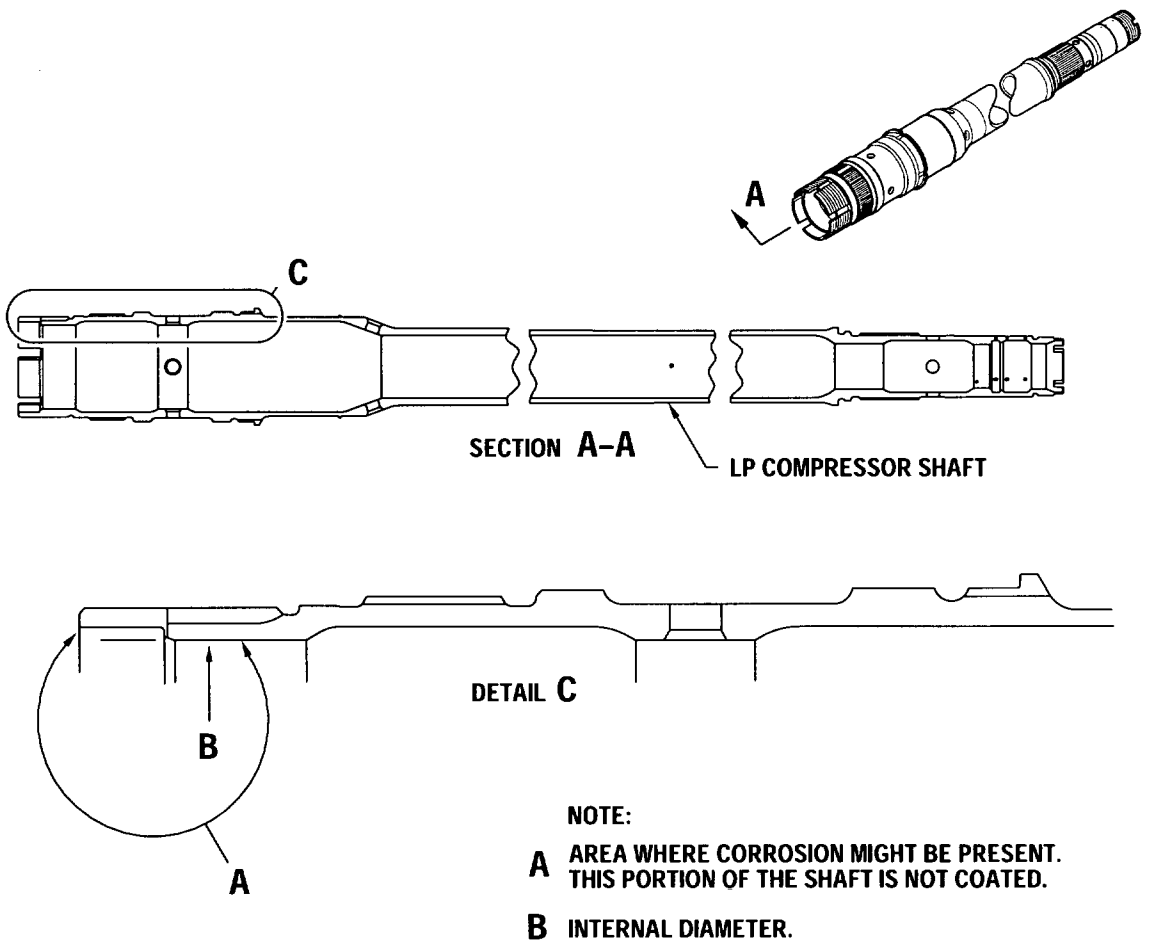
Intermediate Case Assembly
Figure 801



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Removal of Corrosion on the LP Compressor Shaft Internal Bore
Figure 802

GAS GENERATOR CASE - INSPECTION/CHECK

1. General

   A. This section provides instructions and limits for inspection/check of the gas generator case assembly.

   B. It is recommended that a magnifying glass of at least 10X power be used when visually inspecting for damage.

   C. Within the following text, where the term nicks or dents is used, unless otherwise specified, blend repair limits are applicable provided at least 70 percent of original surface remains undamaged.

   D. Parts found unsuitable for further engine running should be replaced. Rejected parts should be returned to Pratt & Whitney Canada for complete inspection and possible repair/refurbishment.

2. Consumable Materials

   Not Applicable

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Gas Generator Case Assembly (Ref. Fig. 601)

   A. Check Diffuser Ducts (Fishtails)

      (1) Visually check for:

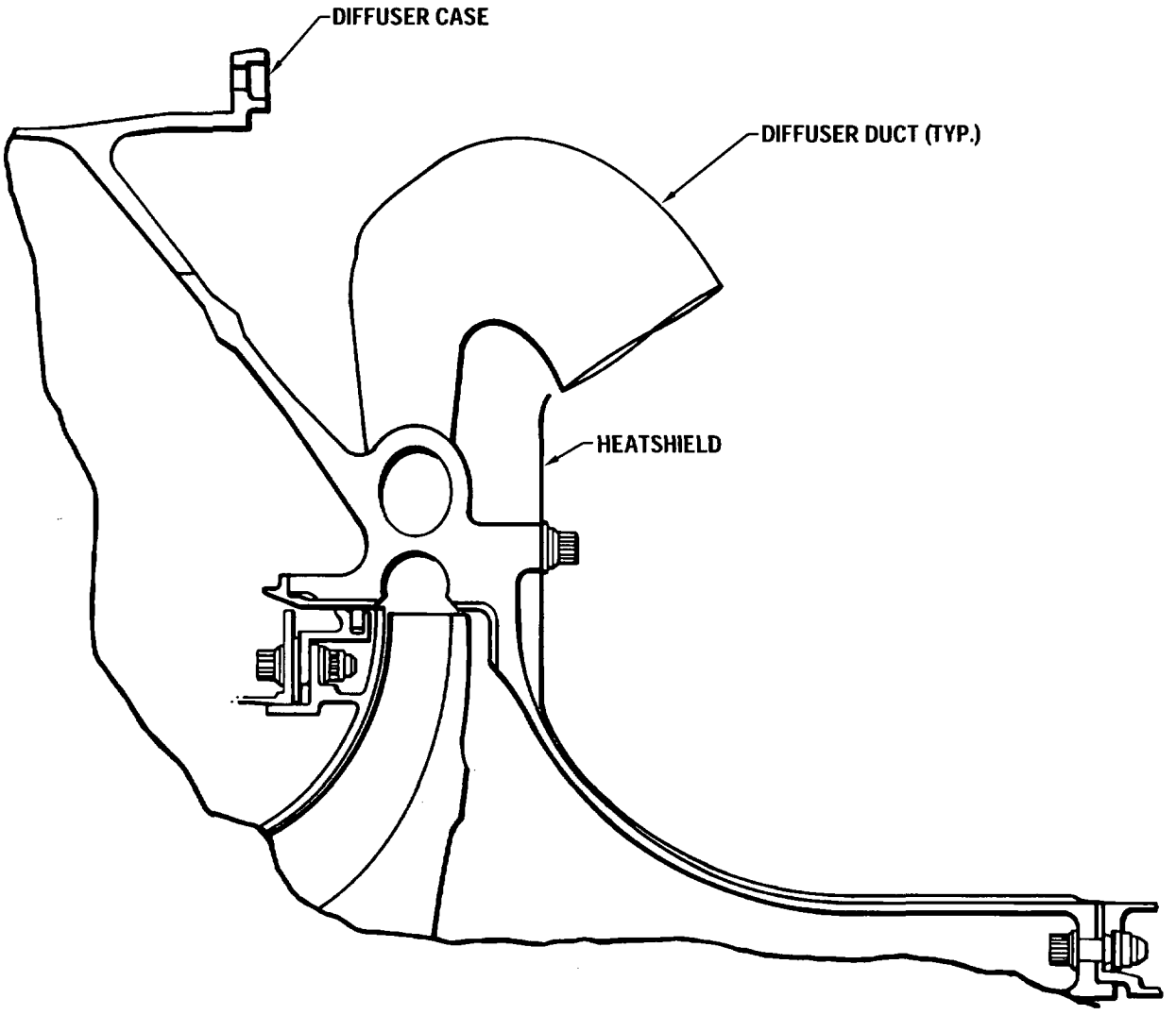
         (a) Cracks, holes and weld integrity. No cracks permitted, replace any damaged ducts.

         (b) Nicks or dents. Maximum of 10 acceptable to a depth of 0.003 inch (0.08 mm) provided nicks and/or dents separated by a minimum of 0.250 inch (6.4 mm) (two occurrences separated by a minimum of 0.100 inch (2.5 mm) is acceptable) and damage is removed by blending to a maximum depth of 0.005 inch (0.13 mm).

      (2) Check torque of duct retaining bolts. Torque as necessary 32 to 36 lb.in. (3.6-4.0 Nm). If torque value is not achieved, replace Helicoil insert with oversize inserts as necessary (Ref. 70-00-00, STANDARD PRACTICES).

   B. Check Diffuser Heat Shield

      (1) Visually check:



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Gas Generator Assembly
Figure 601

(a) Nicks, burrs and raised metal. Stone to remove raised metal or sharp edges.

(b) Local wear or damage is acceptable to a maximum depth of 0.005 inch provided wear or damage occurs circumferentially.

CAUTION: MAKE SURE DRILL DOES NOT DAMAGE DIFFUSER CASE.

(c) Cracks. Vee out crack(s) using a suitable abrasive wheel. Stop drill where practical using a 1/16 inch drill.

(2) Shield assembly with damage in excess of above limits must be replaced.

C. Check Diffuser Case

(1) Visually check for cracks. No cracks permitted.

TABLE OF CONTENTS

SUBJECT	PAGE
COMBUSTION SECTION - DESCRIPTION AND OPERATION	**72-40-00**
1. Combustion Chamber Outer Case)	1
2. Combustion Chamber Liner)	1
COMBUSTOR - REMOVAL/INSTALLATION	**72-40-01**
1. General	401
2. Consumable Materials	401
3. Special Tools	401
4. Fixtures, Equipment and Supplier Tools	401
5. Combustor Assembly - Removal	402
A. Procedure	402
6. First-stage HP Turbine Vane and Combustion Chamber Liner Assembly - Removal	403
A. Removal of First-stage HP Turbine Vane	403
B. Disassembly of First-stage HP Turbine Vane (Pre-SB24174)	403
C. Disassembly of First-stage HP Turbine Vane (Post-SB24174 or Pre-SB24490 or Pre-SB24516)	405
D. Disassembly of First-stage HP Turbine Vane (Post-SB24174 and (Post-SB24490 or Post-SB24516))	405
7. Combustion Chamber Liner (Post-SB24490 or Post-SB24516)	407
A. Disassembly of Combustion Chamber Liner	407
B. Assembly of Combustion Chamber Liner	407
8. First-stage HP Turbine Vane - Assembly	409
A. Procedure (Pre-SB24174)	409
B. Procedure (Post-SB24174 or Pre-SB24490 or Pre-SB24516)	411
C. Procedure (Post-SB24174 and (Post-SB24490 or Post-SB24516))	415
9. Combustion Chamber Liner and First-stage Vane - Assembly	417
A. Procedure (Pre-SB24490 or Pre-SB24516)	417

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TABLE OF CONTENTS

SUBJECT	PAGE
COMBUSTOR - REMOVAL/INSTALLATION (Cont'd)	**72-40-01**
B. Installation of Combustion Chamber Liner In Combustion Chamber Outer Case (Post-SB24490 or Post-SB24516)	426
10. Combustion Chamber Outer Case Assembly - Installation	426
A. Procedure	426
11. Engine Assembly	427
A. Assembly of Engine After Combustor Installation	427
COMBUSTOR - INSPECTION/CHECK	**72-40-01**
1. General	601
2. Consumable Materials	601
3. Special Tools	601
4. Fixtures, Equipment and Supplier Tools	601
5. Combustion Chamber Outer Case Assembly	601
A. Visual Check	601
6. Combustion Chamber Liner	602
A. Visual Check	602

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LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Nov 28/2008
	2 blank	Nov 28/2008
Contents	1	Nov 28/2008
	2	Nov 28/2008
72-40-00	1	Nov 19/99
Description and	2	Nov 19/99
Operation	3	Nov 19/99
	4 blank	Nov 19/99
72-40-01	401	Nov 09/2007
Removal/	402	Nov 09/2007
Installation	403	Nov 09/2007
	404	Nov 09/2007
	405	Nov 09/2007
	406	Nov 09/2007
	407	Nov 09/2007
	408	Nov 09/2007
	409	Nov 09/2007
	410	Nov 09/2007
	411	Nov 09/2007
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	422	Nov 09/2007
	423	Nov 09/2007
	424	Nov 09/2007
	425	Nov 09/2007
	426	Nov 09/2007
	427	Nov 09/2007
	428	Nov 09/2007
	429	Nov 09/2007
	430 blank	Nov 09/2007

CHAPTER SECTION	PAGE	DATE
72-40-01	601	Nov 28/2008
Inspection	602	Nov 28/2008
Check	603	Nov 28/2008
	604	Nov 28/2008
	605	Nov 28/2008
	606	Nov 28/2008
	607	Nov 28/2008
	608	Nov 28/2008
	609	Nov 28/2008
	610	Nov 28/2008
	611	Nov 28/2008
	612	Nov 28/2008
	613	Nov 28/2008
	614	Nov 28/2008

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COMBUSTION SECTION - DESCRIPTION AND OPERATION

1. Combustion Chamber Outer Case (Ref. Fig. 1)

The combustion chamber outer case consists of a nickel-alloy weldment with the front flange bolted to the gas generator case (Flange H). The rear flange is bolted to the low pressure turbine case (Flange E) and supports the high pressure turbine stator support.

Bosses on the conical section at the 4 and 5 o'clock positions provide for the insertion of spark igniters, while 24 equally spaced bosses slightly forward of the igniters provide for fuel nozzle adapters. Fuel nozzle bosses at the 4 and 5 o'clock positions provide for two hybrid-type fuel nozzles. Bosses at the 3 and 9 o'clock positions toward the front end of the case provide an offtake for P3 cabin bleed air.

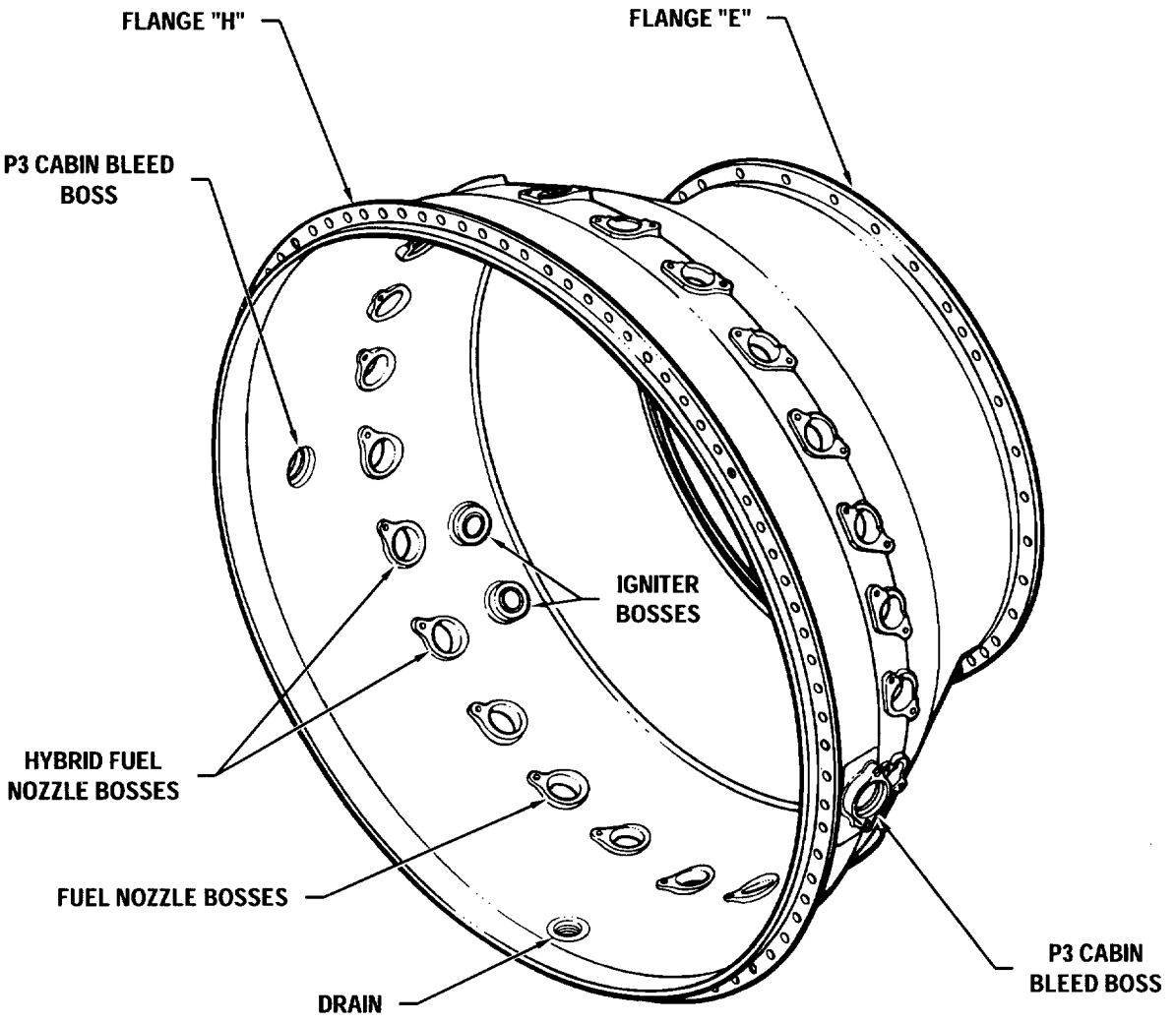
A drain hole towards the front of the conical section at the 6 o'clock position allows residual fuel to drain overboard through the drain valve.

2. Combustion Chamber Liner (Ref. Fig. 2)

The combustion chamber liner is a straight-through annular type, consisting of a nickel-alloy weldment and is contained by the combustion chamber outer case. Twenty-four fuel nozzle sleeves are equally spaced around the domed end, along with two spark igniter suspension collars located at the 4 and 5 o'clock positions.

A series of perforations allow air to enter the liner in a manner designated to provide the best fuel/air ratios for engine starting and sustained combustion with minimum exhaust smoke. Direction of airflow, uniform wall cooling and extended durability is provided by cooling rings, while a conical heatshield, secured in place with 3 bolts to the gas generator case, provides extra thermal protection for the No. 3 bearing area.

The combustion chamber liner is supported at the domed end by the fuel nozzles and by means of a flexible support bolted to the HP turbine stator.



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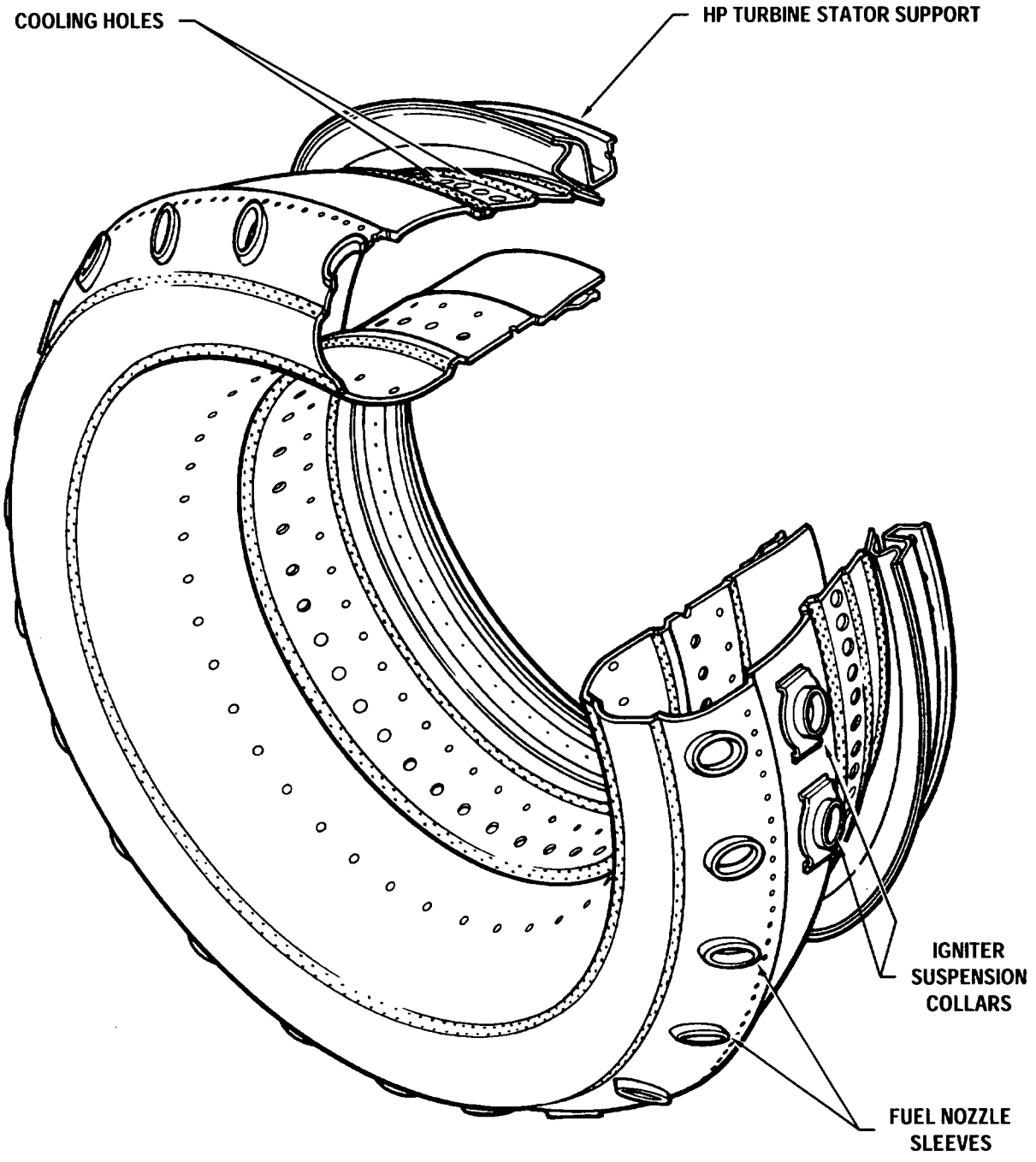
Combustion Chamber Outer Case
Figure 1



Combustion Chamber Liner
Figure 2

COMBUSTOR - REMOVAL/INSTALLATION

1. General

   A. The following section describes the removal and installation of the combustion chamber outer case, combustion chamber liner and the first-stage HP turbine vane assembly. These procedures can only be done during Heavy Maintenance.

   B. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   C. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC04-003	Grease, Synthetic
PWC05-018	Pencil, Metal Marking
PWC05-089	Lockwire
PWC05-279	Permanent Felt Tip Marker
PWC06-032	Compound, Anti-galling and Anti-seize

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC43022	Sling
PWC43209	Puller
PWC43281	Puller
PWC43282	Drift
PWC43285	Base
PWC43572	Locator
PWC61148	Locator
PWC64241-3	Guide Pin

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Combustor Assembly - Removal

NOTE: To facilitate inspection/procurement, the fuel nozzles can be removed from the combustor prior to removal of the combustor from the engine (Ref. 73-10-04)). Re-assembly of the fuel nozzles must be done with the combustor removed from the engine.

A. Procedure (Ref. Fig. 401)

(1) Attach sling (4) (PWC43022) to combustor assembly (8) and attach sling to suitable hoist. Adjust hoist to support the weight of the combustion chamber assembly.

(2) Index mark turbine stator seal (5) at top center position using an approved marker.

CAUTION: DO NOT PUSH ON BOLTS (6). THIS CAN CAUSE CLINCH-NUTS IN GAS GENERATOR CASE TO BE PUSHED OUT.

(3) Remove 15 bolts (6).

NOTE: Bag and identify bolts for treatment with anti-galling compound before installation.

(4) Pre-SB24174:

(a) Remove turbine stator seal (5) using puller (PWC43281).

(5) Post-SB24174:

(a) Turbine stator seal (5) will be removed later, with the combustion chamber liner assembly.

(6) Remove 11 nuts (9), 11 bolts (11) and upper bracket assembly (2) (Ref. Location B).

(7) Remove nine nuts (9), nine bolts (11) and lower bracket assembly (7) (Ref. Location B).

(8) Remove remaining 80 nuts (9), bolts (10, 12) and four blanking plates (3).

(9) Install four jacking screws in holes previously covered by blanking plates (3).

(10) Pre-SB24490 or Pre-SB24516: Slowly separate combustor chamber outer case and liner assembly (8) from gas generator case (1) by simultaneously turning jacking screws and gently tapping on the front face of the turbine disk air nozzle (14) with puller (PWC43209).

(11) Post-SB24490 or Post-SB24516: Remove combustion chamber case assembly by alternating between jacking screws and slowly separating combustion chamber outer case and liner assembly (8) from gas generator case (1).

(12) Put combustor on bench and remove sling.

(13) Pre-SB24174:

(a) Temporarily secure turbine stator seal (5), to first-stage vane assembly using three slave nuts and bolts.

(14) Post-SB24174:

(a) Temporarily secure first-stage vane assembly together, using three slave nuts and bolts.

(15) Remove jacking screws from combustor case.

(16) Remove igniters(Ref. 74-10-01).

(17) Mark each fuel nozzle to identify the exact location in the combustion chamber outer case using an approved marker.

(18) Remove primary and secondary fuel nozzles from combustor assembly (Ref. 73-10-04).

(19) Remove three fuel nozzle locators (PWC43572) and lower combustion chamber liner assembly (1) to bench.

6. First-stage HP Turbine Vane and Combustion Chamber Liner Assembly - Removal

NOTE: The first-stage HP turbine vane and combustion chamber liner should be inspected as an assembly and therefore does not need to be disassembled. If damage is noted, disassemble as required.

A. Removal of First-stage HP Turbine Vane (Ref. Fig. 402 and 404)

(1) Index mark first-stage vane assembly (2, Fig. 402) to combustion chamber liner assembly (1) at top center position using an approved marker.

(2) Pre-SB24490 or Pre-SB24516:

(a) Separate combustion chamber liner (1) and first-stage vane assembly (2) by removing 24 self-locking nuts (5) and bolts (3) (Ref. Fig. 402).

(b) Temporarily attach turbine retaining plate (10, Fig. 404) to first-stage HP turbine vane shroud (12) with three slave nuts (11) and bolts (9), equally spaced around flange.

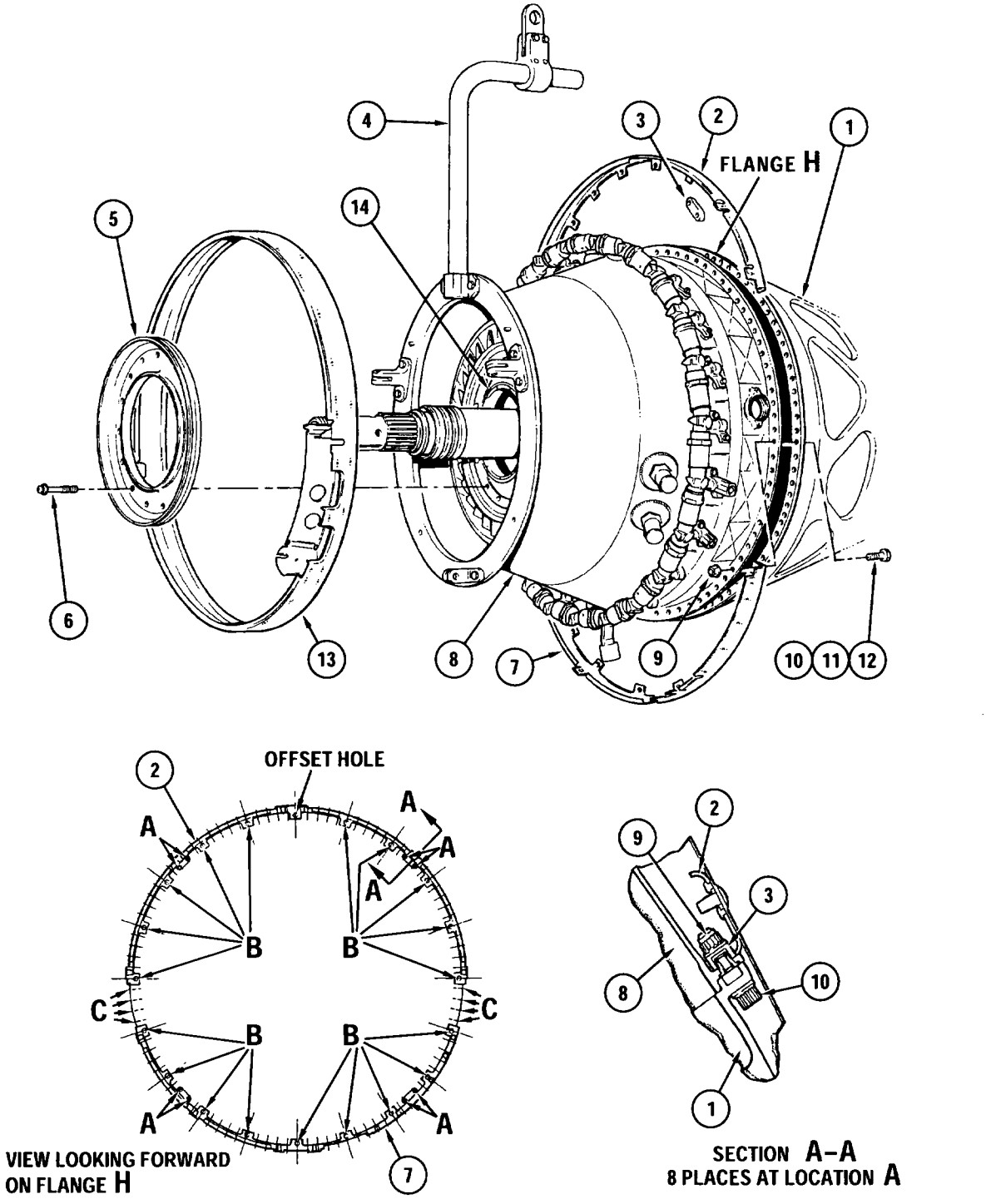
B. Disassembly of First-stage HP Turbine Vane (Pre-SB24174) (Ref. Fig. 404)

(1) Number all vane segments (1) for correct location using an approved marker.

(2) Remove slave nuts (11) and bolts (9). Separate and remove first-stage HP turbine vane shroud (12) and turbine vane retaining plate (10).

(3) Remove slave nuts (3), bolts (5) and turbine stator seal assembly (2).

(4) Separate and remove 32 first-stage HP turbine vane assemblies (1) from first-stage HP turbine vane shroud (6).



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Removal/Installation of Combustion Chamber Outer Case and Liner Assembly
Figure 401

Key to Figure 401

1. Gas Generator/Diffuser Case (Ref.)
2. Upper Bypass Duct Bracket Assembly
3. Jacking Insert Blanking Plate
4. Sling (PWC43022)
5. Turbine Stator Seal
6. Bolt
7. Lower Bypass Duct Bracket Assembly
8. Combustion Chamber Outer Case and Liner Assembly
9. Self-locking Nut
10. Bolt
11. Bolt
12. Bolt
13. Rear Support Ring
14. Turbine Disk Air Nozzle Assembly

(5) Remove and discard inner and outer turbine vane air seals (7, 8).

(6) Remove turbine disk air nozzle (4).

C. Disassembly of First-stage HP Turbine Vane (Post-SB24174 or Pre-SB24490 or Pre-SB24516) (Ref. Fig. 405)

(1) Put first stage turbine vane assembly on bench with turbine retaining plate (5) up.

(2) Remove three slave nuts (7) and bolts (6) securing plate (5).

(3) Remove plate (5).

(4) Lift vane assembly out of vane shroud (4).

(5) Remove three slave nuts (7) and bolts (6).

(6) Remove turbine vane shroud (3).

(7) Separate and remove 10 first stage HP turbine vane shrouds segments (1).

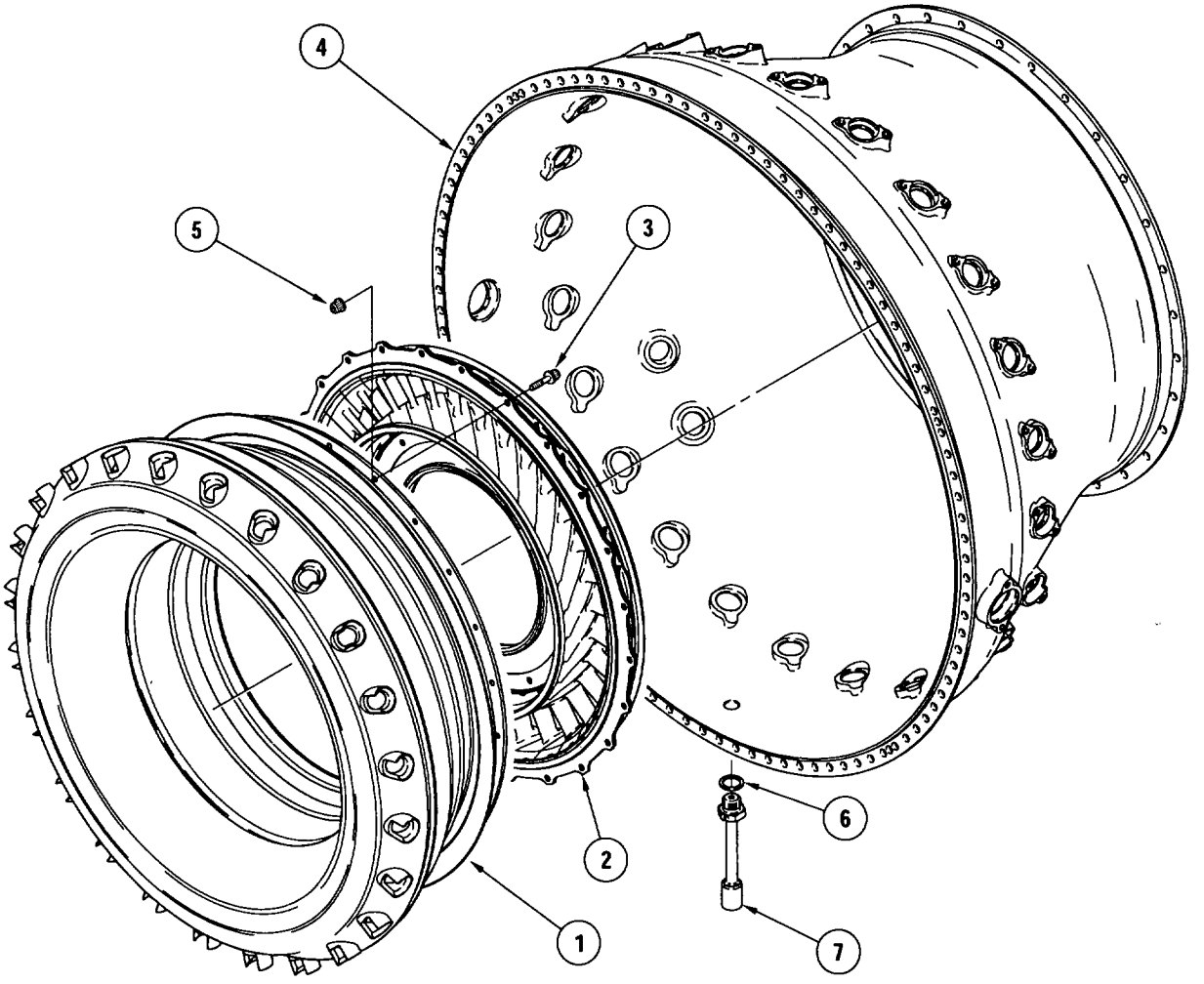
(8) Remove 20 vane air seals.

D. Disassembly of First-stage HP Turbine Vane (Post-SB24174 and (Post-SB24490 or Post-SB24516)) (Ref. Fig. 406)

(1) Put first stage HP turbine vane assembly on the bench with seal support (8) down.

(2) Number all vane segments (6) starting with vane number 1 at the X-marked offset hole. Continue in a clockwise direction number the segments one thru ten, with approved marker (PWC05-279) or (PWC05-018).

(3) Remove slave nuts (1) and bolts (4).



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Removal/Installation of First-stage HP Turbine Vane and Combustion Chamber Liner (Pre-SB24490 or Pre-SB24516)
Figure 402

Key to Figure 402

1. Combustion Chamber Liner Assembly
2. HP Turbine First-stage Vane Assembly
3. Bolt
4. Combustion Chamber Outer Case Assembly
5. Self-locking Nut
6. Gasket
7. Drain Tube Adapter

(4) Press turbine disk air nozzle assembly (3) out of vane assembly with a suitable drift.

(5) Remove bolts (10) and seal support (8).

(6) Remove vane shroud (11).

(7) Turn vane assembly over on bench.

(8) Separate vane shroud (7) from turbine stator seal (2).

(9) Remove 10 first stage HP turbine vane assemblies (6).

(10) Separate and remove 20 turbine vane air seals (5).

7. Combustion Chamber Liner (Post-SB24490 or Post-SB24516) (Ref. Fig. 407)

A. Disassembly of Combustion Chamber Liner

(1) Remove 24 bolts (2).

(2) Separate outer liner (1) and inner liner (3).

B. Assembly of Combustion Chamber Liner

(1) Install alignment pins (PWC64241-3), one in offset hole of inner liner (3).

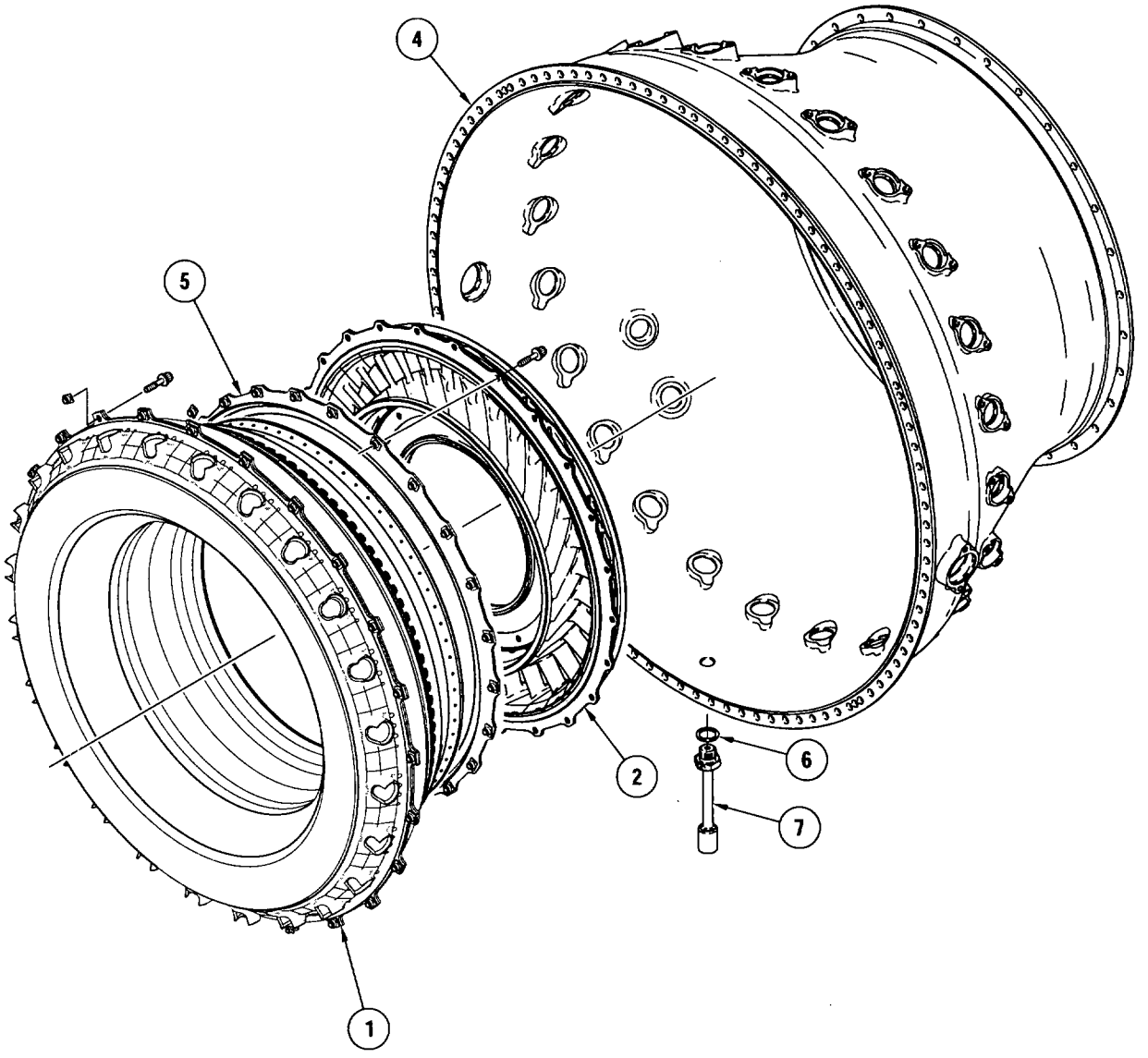
(2) Install outer liner (1) over inner liner (3) aligning pin and offset hole of outer liner.

(3) Remove alignment pins.

(4) Lubricate bolt (2) with engine oil (PWC03-001) and install in offset hole.

(5) Lubricate remaining bolts with engine oil (PWC03-001) and install around inner and outer flange.

(6) Starting with bolt at offset hole, tighten bolts 36 to 40 lb.in (4.0-4.6 Nm) in a star pattern.



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Removal/Installation of First-stage HP Turbine Vane and Combustion Chamber Liner
(Post-SB24490 or Post-SB24516)
Figure 403

Key to Figure 403

1. Inner and Outer Combustion Chamber Liner Assemblies
2. HP Turbine First-stage Vane Assembly
3. Bolt
4. Combustion Chamber Outer Case Assembly
5. Rear Combustion Liner Seal Support
6. Gasket
7. Drain Tube Adapter

8. First-stage HP Turbine Vane - Assembly

A. Procedure (Pre-SB24174) (Ref. Fig. 408)

(1) Install 32 outer and inner turbine vane air seals (2 and 9) in 32 first-stage HP turbine vane assemblies (1).

NOTE: Make sure vane assemblies are the same class as those removed. Hold air seals in place with synthetic grease (PWC04-003).

(2) Identify the offset holes in items (5, 7, 3 and 10) using an approved marker.

(3) Put turbine retaining plate (7) on bench.

(4) Put one vane segment (1) on retaining plate (7).

(5) Position remaining 31 vane segments (1) on retaining plate (7), engaging vanes with seals previously fitted.

(6) Install first-stage HP turbine vane shroud (3) on vane ring assembly aligning offset hole with offset hole in retaining plate (7). Make sure alignment lugs engage.

(7) Align offset holes and secure retaining plate (7) to vane shroud (3) with four equally spaced slave nuts (8) and bolts (6). Torque 36 to 40 lb.in. (5.5-6.0 Nm).

(8) Place vane ring assembly on bench with retaining plate (7) facing up.

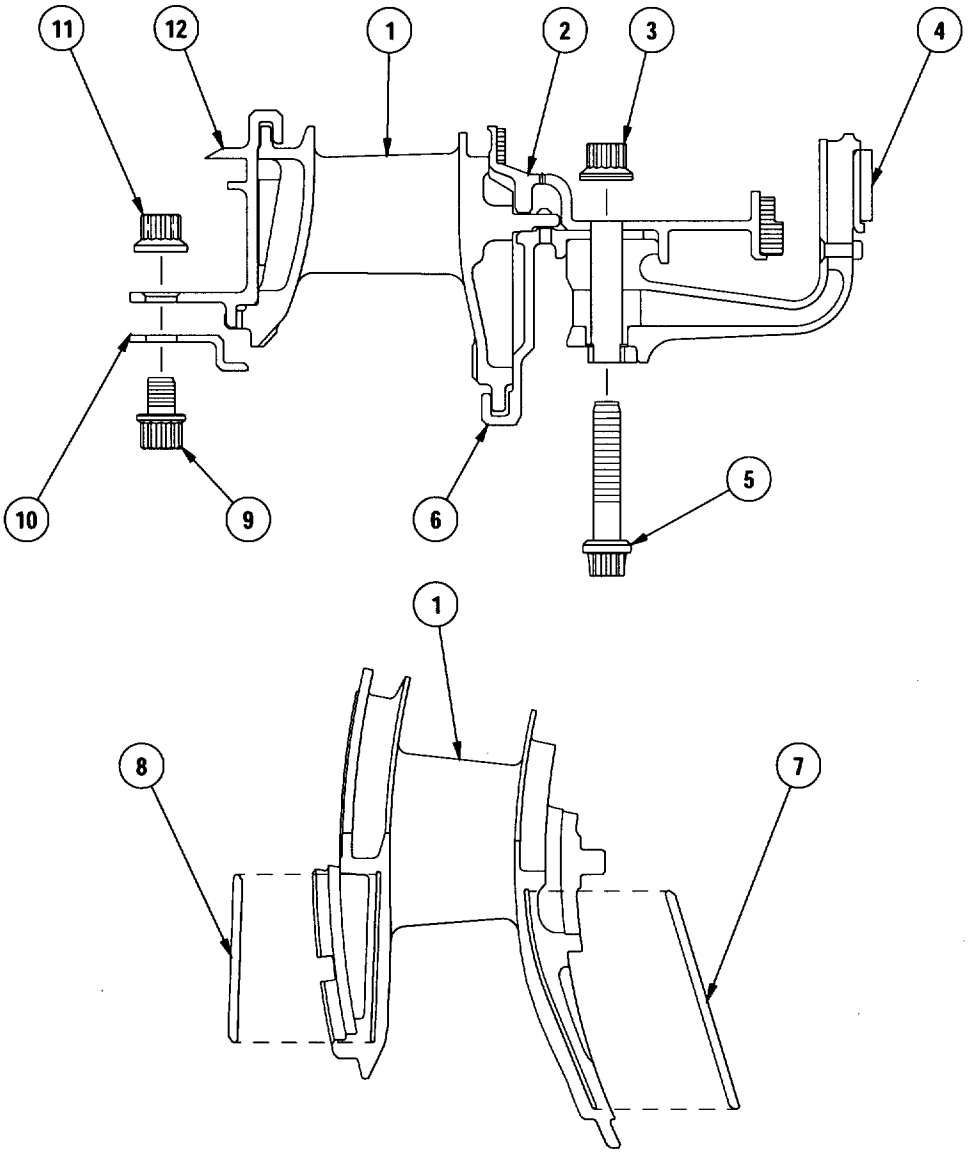
(9) Install vane shroud (5) on vane ring assembly, aligning offset hole in vane shroud (5) with same in retaining plate (7).

(10) Turn vane ring assembly over on bench, with retaining plate (7) down.

(11) Measure gaps between vane segments at 32 places (Ref. 72-50-01 Fits and Clearances REF. NO. 1808).

(12) Adjust gaps between segments by tapping lug at inside diameter of vane in direction required, using a soft-faced drift.

(13) Align offset holes in vane shroud (5) with stator seal (10) and install stator seal. Secure using four equally spaced (slave) nuts and bolts (8 and 6). Torque 36 to 40 lb.in. (5.5-6.0 Nm).



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Disassembly of First-stage HP Turbine Vane (Pre-SB24174)
Figure 404

Key to Figure 404

1. First-stage HP Turbine Vane (Single-segment)
2. Turbine Stator Seal Assembly
3. Nut (Slave)
4. Turbine Disk Air Nozzle Assembly
5. Bolt (Slave)
6. First-stage HP Turbine Vane Shroud
7. Inner Turbine Vane Air Seal
8. Outer Turbine Vane Air Seal
9. Bolt (Slave)
10. Turbine Retaining Plate
11. Nut (Slave)
12. First-stage HP Turbine Vane Shroud

B. Procedure (Post-SB24174 or Pre-SB24490 or Pre-SB24516) (Ref. Fig. 405)

(1) Identify the offset hole in items (2, 3, 4 and 5) with an approved marker.

(2) Install 20 turbine vane air seals (8) in 10 first-stage HP turbine vanes (1).

NOTE: Make sure vane assemblies are the same class as those removed. Hold air seals in place with synthetic grease (PWC04-003).

(3) Put turbine stator seal (2) on bench rear face down.

(4) Install one HP turbine vane segment (1) on stator seal (2), leading edge up. Engage anti-rotation features.

CAUTION: DO NOT FORCE VANE SEGMENTS TOGETHER. DAMAGE TO AIR SEAL COULD RESULT.

(5) Install remaining nine vane segments (1) on stator seal (2) in a counter clockwise direction, engaging seals and anti-rotation features.

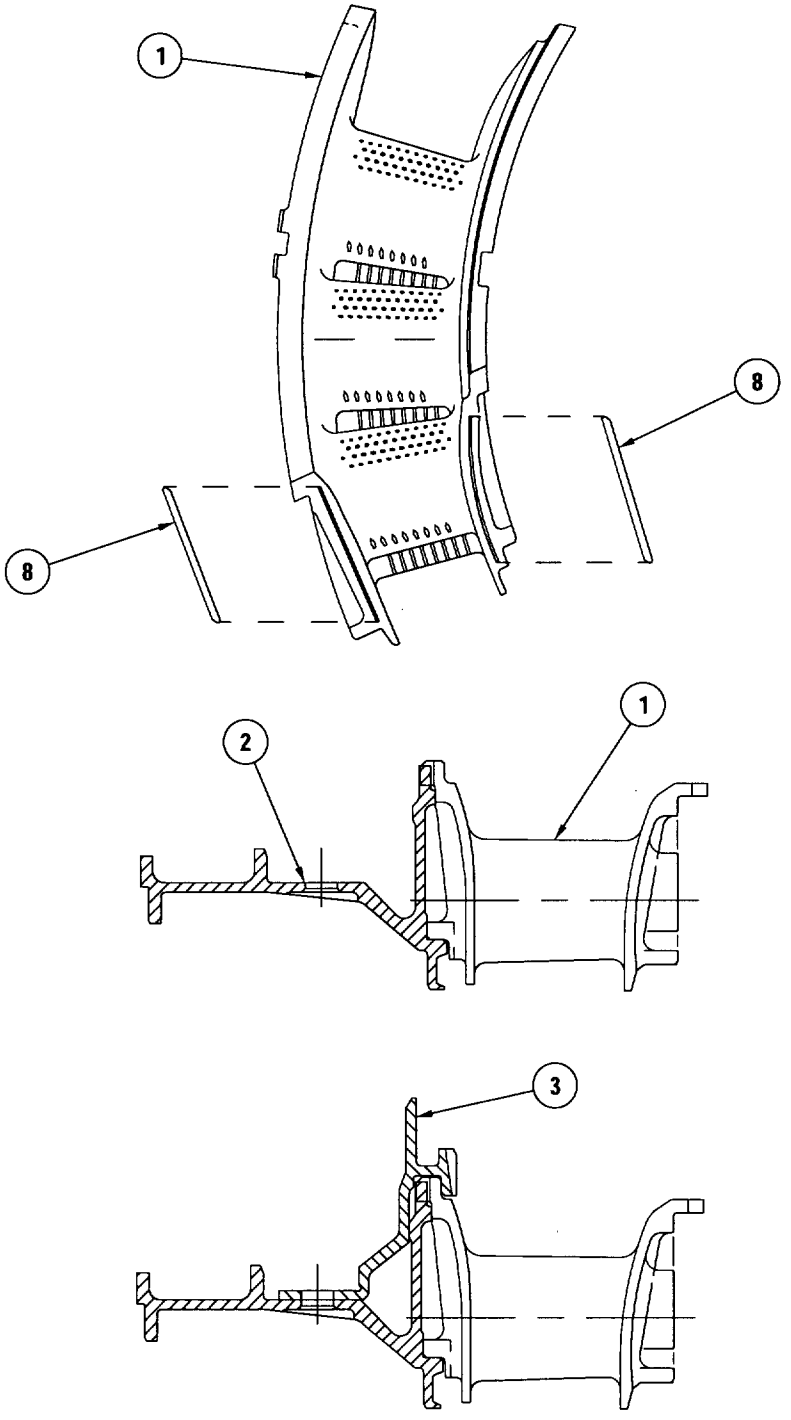
(6) Install vane shroud (3) aligning offset holes. Secure using three slave nuts (7) and bolts (6).

(7) Carefully lift the vane assembly and install it on vane shroud (4) aligning offset holes.

(8) Install retaining plate (5). Attach with three slave nuts (7) and bolts (6).

(9) Turn assembly over on bench so that retaining plate (5) is down.

(10) Measure gaps between HP turbine vane segments (1) at 10 places, (Ref. Section A-A). Gaps must be within tolerance (Ref. 72-50-01 Fits and Clearances REF. NO. 1808).



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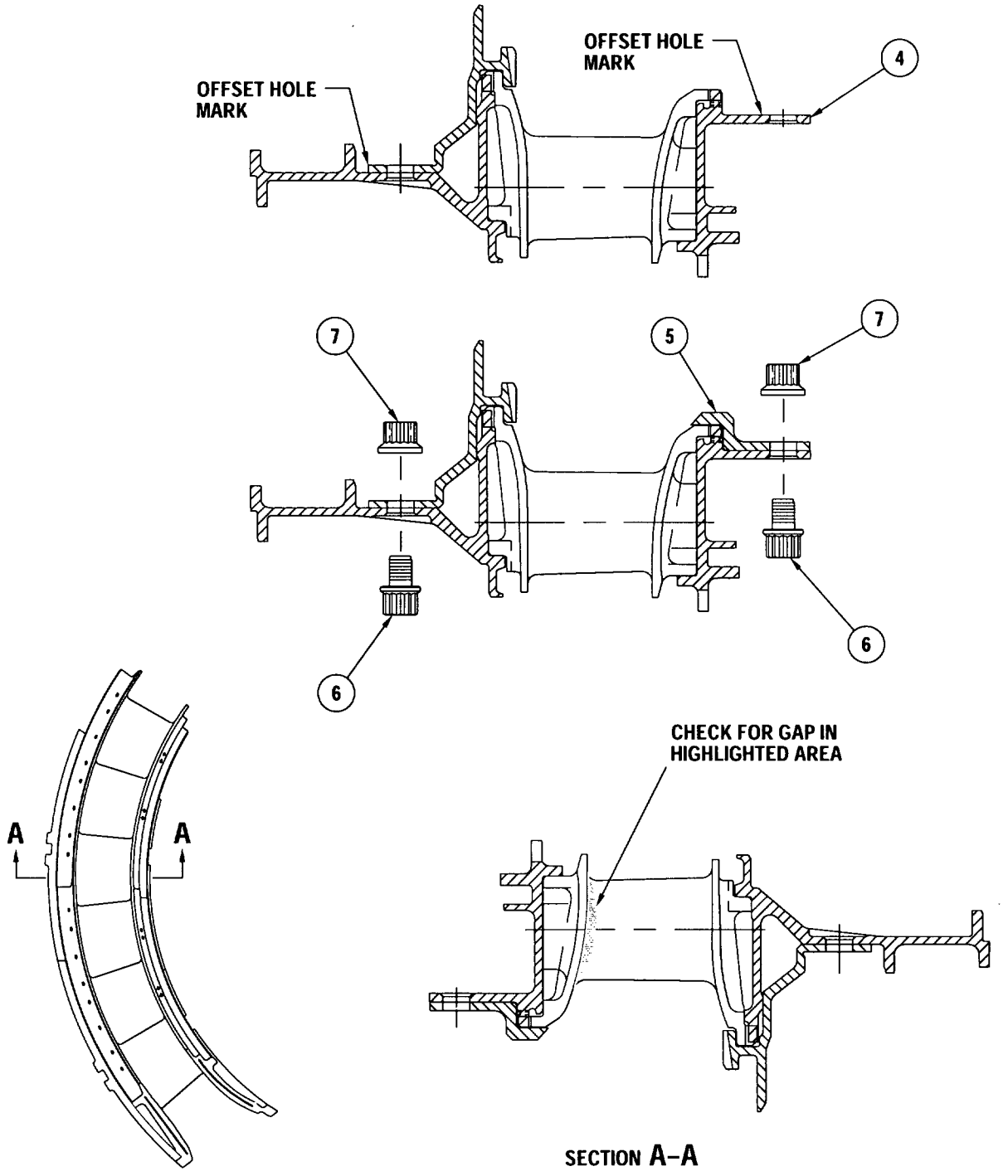
Disassembly of First-stage HP Turbine Vane (Post-SB24174 or Pre-SB24490 or Pre-SB24516)
Figure 405 (Sheet 1 of 2)

Key to Figure 405

1. First-stage HP Turbine Vane(Triple-Vane, Post-SB24174)
2. Turbine Stator Seal Assembly
3. First-stage HP Turbine Vane Shroud
4. First-stage HP Turbine Vane Shroud
5. Turbine Retaining Plate
6. Bolt (Slave)
7. Nut (Slave)
8. Turbine Vane Air Seal



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Disassembly of First-stage HP Turbine Vane (Post-SB24174 or Pre-SB24490 or Pre-SB24516)
Figure 405 (Sheet 2)

(11) Adjust gaps between segments by tapping lug on inside diameter of vane, in direction required, with a soft-faced drift.

C. Procedure (Post-SB24174 and (Post-SB24490 or Post-SB24516)) (Ref. Fig. 409)

(1) Find and mark the offset hole in items (3, 4, 7 and 8) with an X-mark with an approved marker (PWC05-279) or (PWC05-018).

CAUTION: MAKE SURE VANE ASSEMBLIES ARE THE SAME CLASS AS THOSE REMOVED.

(2) Find if new or used serviceable vanes are being installed and continue as follows:

(a) If used vanes are being installed and the location numbers are visible go to step (6) (Ref. 72-50-01, F & C REF. NO. 1851).

(b) If new vanes are being installed or the location numbers are not visible go to step (3) (Ref. 72-50-01, F & C REF. NO. 1851).

(3) Put 10 vane segments (1) on the bench with leading edges up. Put the vanes in sequence from lowest to highest class.

(4) Starting with the lowest class vane as number one and finishing with the highest class vane as number ten mark a sequence number on each vane with an approved marker (PWC05-279) or (PWC05-018).

(5) Record the vane class and position number of all 10 vane segments.

CAUTION: MAKE SURE SEALS FOLLOW THE CONTOUR OF THE VANE.

(6) Install two turbine vane air seals (2) in each of 10 vane segments (1). Hold air seals in place with grease (PWC04-003).

(7) Put turbine stator seal (3) on bench with rear face down.

(8) Install HP turbine vane segment numbered "1" on stator seal (3) with leading edge up at the X-marked offset hole position (Ref. View A). Engage anti-rotation features.

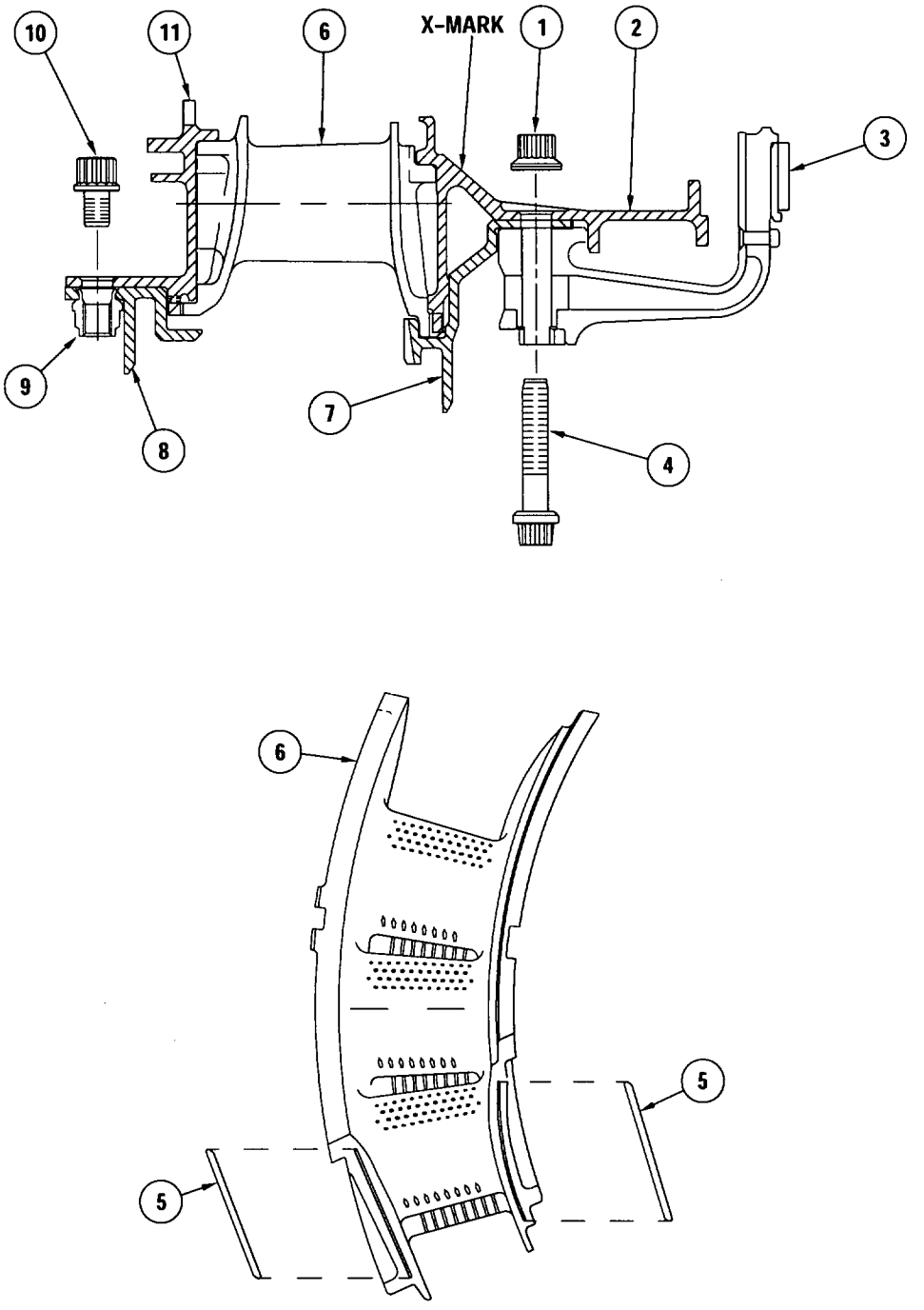
CAUTION: DO NOT FORCE VANE SEGMENTS TOGETHER, DAMAGE TO AIR SEAL COULD RESULT.

(9) Install remaining nine vane segments in sequence numbered "2" to "10" on stator seal (3) in a counterclockwise direction engaging seals and anti-rotation features.

CAUTION: MAKE SURE ALL VANE SLOTS ARE ENGAGED WITH STATOR SEAL LUGS.

(10) Install slave preformed packing (AS3209-278) around the outside diameter of the vanes to hold them together.

(11) Install vane shroud (4) aligning X-marked offset holes. Attach stator seal (3) with three slave nuts (6) and bolts (5) equally spaced around flange. Torque nuts 36 to 40 lb.in. (4.0-4.5 Nm).



C84540

Disassembly of First-stage HP Turbine Vane (Post-SB24174 and (Post-SB24490 or Post-SB24516))
Figure 406

Key to Figure 406

1. Nut (Slave)
2. Turbine Stator Seal
3. Turbine Disk Air Nozzle Assembly
4. Bolt (Slave)
5. Turbine Vane Air Seal
6. First-stage HP Turbine Vane
7. First-stage HP Turbine Vane Shroud
8. Combustion Liner Rear Seal Support Assembly
9. Shank Nut (Part of item 8)
10. Bolt
11. First-stage HP Turbine Vane Shroud

(12) Put vane shroud (7) on bench with front flange up.

(13) Carefully lift the vane assembly and install it in vane shroud (7) aligning the X-marked offset holes. Remove slave packing as necessary.

CAUTION: KEEP BOLTS LOOSE SO THAT SEAL SUPPORT CAN MOVE FREELY.

(14) Install seal support (8) aligning the X-marked offset holes. Attach with three equally spaced bolts (9).

NOTE: Bolts will be torqued after vane is installed.

(15) Turn assembly over on bench so that bolts (9) are up.

(16) Measure gaps between HP turbine vane segments (1) at 10 places. Gaps must be within limits (Ref. 72-50-01, F & C REF. NO. 1808).

(17) Adjust gaps between segments by tapping the lug on inside diameter of vane, in the necessary direction, with a soft-faced drift.

CAUTION: KEEP BOLTS LOOSE SO THAT SEAL SUPPORT CAN MOVE FREELY.

(18) Install remaining 21 bolts (9).

NOTE: Bolts will be torqued after vane is installed.

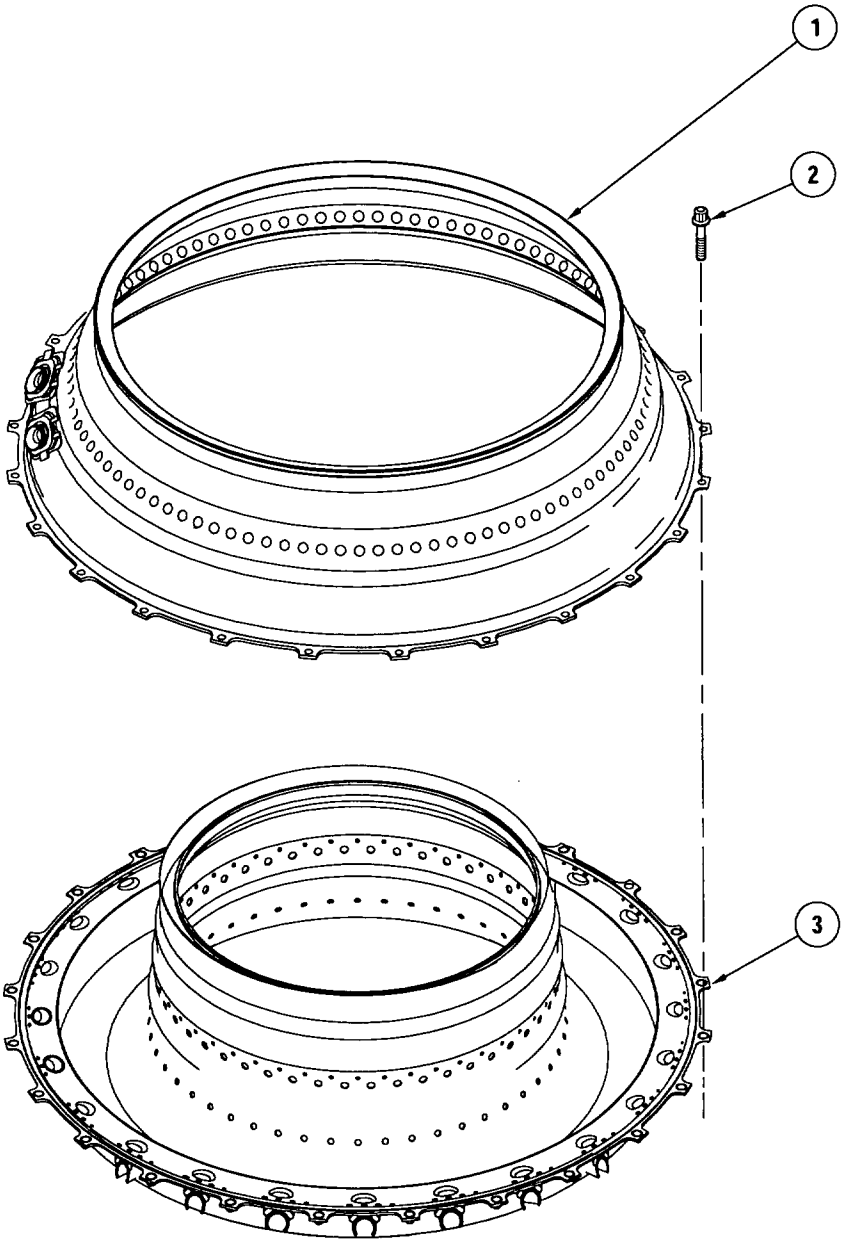
(19) Tag and identify vane with engine serial number.

(20) Put vane on part stand until needed.

9. Combustion Chamber Liner and First-stage Vane - Assembly

A. Procedure (Pre-SB24490 or Pre-SB24516) (Ref. Fig. 402 and 404)

(1) Pre-SB24174:



C73473

Disassembly/Assembly of Combustion Chamber Liner (Post-SB24490 or Post-SB24516)
Figure 407

Key to Figure 407

1. Outer Liner
2. Bolt
3. Inner Liner

(a) Freeze turbine stator seal (2, Fig. 404) to -40°C (-40°F) for a minimum of 15 minutes.

CAUTION: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(2) Put first-stage vane assembly (2, Fig. 402) in oven pre-heated to 180°C (350°F) for minimum 15 minutes.

(3) Install base (PWC43285) in a vice.

(4) Install turbine disk air nozzle (4, Fig. 404) on base (PWC43285).

(5) Identify the offset hole in the turbine disk air nozzle with an approved marker.

CAUTION: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(6) Remove first-stage vane assembly from oven. Remove slave bolts and install vane assembly on turbine disk air nozzle (4) aligning off-set holes.

(7) Pre-SB24174:

(a) Remove stator seal from freezer and install on turbine disk air nozzle (4) aligning off set holes. Attach with three nuts (3) and bolts (5). Allow assembly to cool to room temperature.

(8) Heat rear flange of combustion chamber liner (1, Fig. 402) for 10 minutes using a suitable heat gun.

(9) Carefully remove slave nuts (11, Fig. 404) and bolts (9) from vane assembly.

(10) Install vane assembly (2, Fig. 402) on combustion chamber liner (1) aligning offset holes.

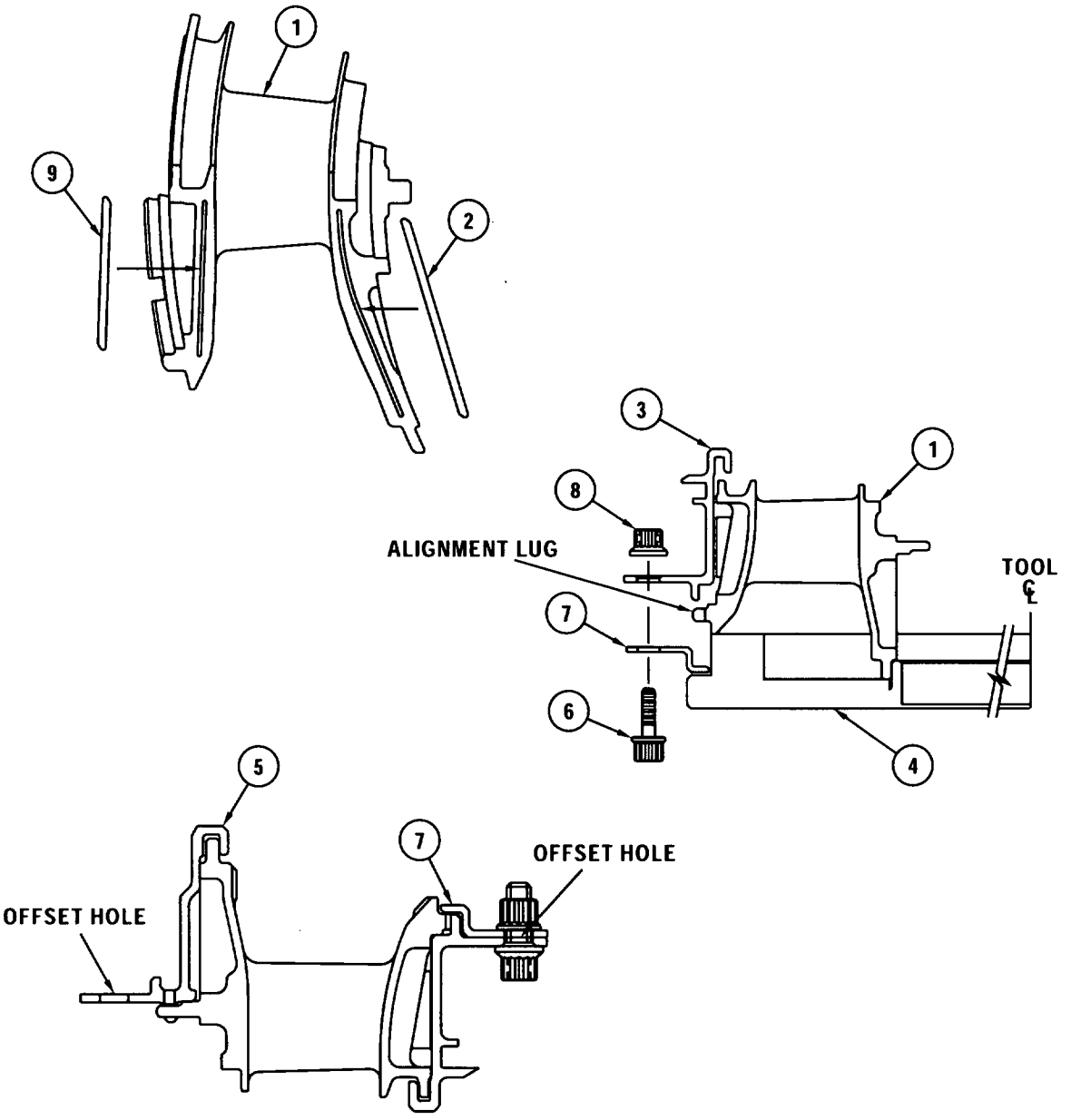
(11) Secure vane assembly (2) with 24 bolts (3) and 24 self-locking nuts (5), torque 36 to 40 lb. in. (4.0-4.6 Nm).

(12) Put combustion chamber assembly on bench with vane (2) up.

(13) Place combustion chamber outer case assembly (4) over combustion chamber liner assembly (1).

(14) Align igniter plug bosses in combustion chamber liner (1) with same in outer case (4). Install three locators (PWC43572), 120 degrees apart in three fuel nozzle bosses.

(15) Install igniter plugs in combustion chamber outer case assembly (Ref. 74-10-01).

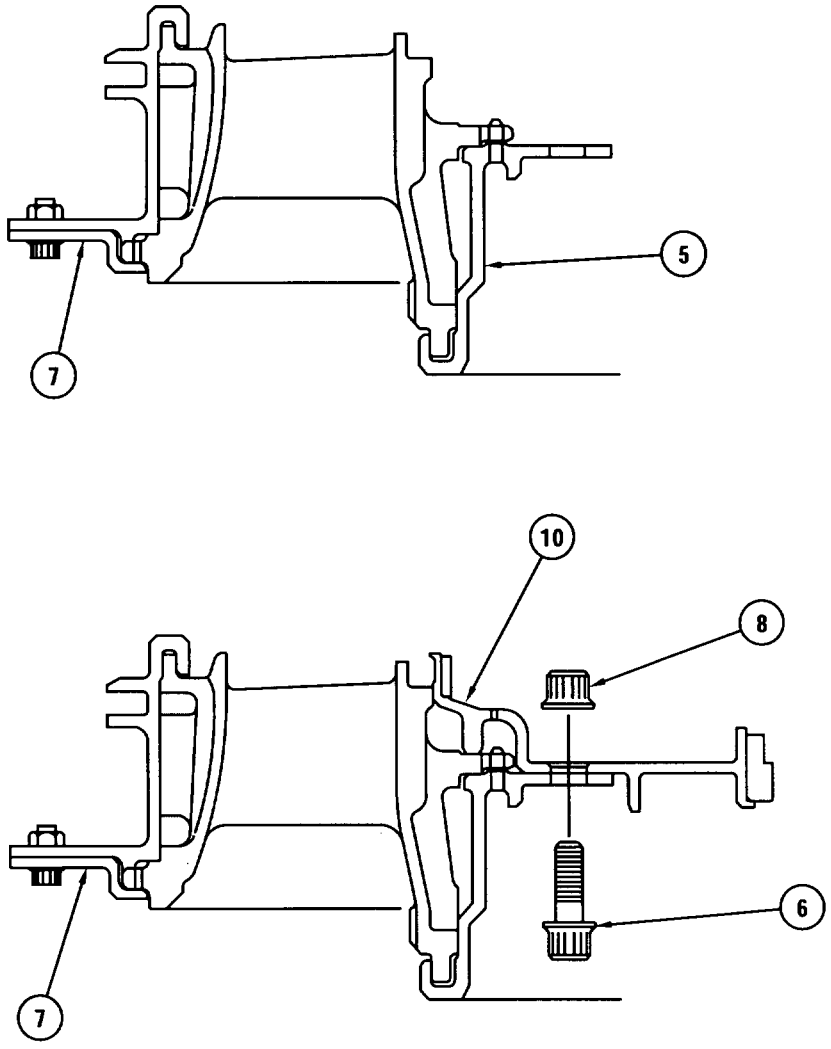


C31509

Assembly of First-stage HP Turbine Vane (Pre-SB24174)
Figure 408 (Sheet 1 of 2)

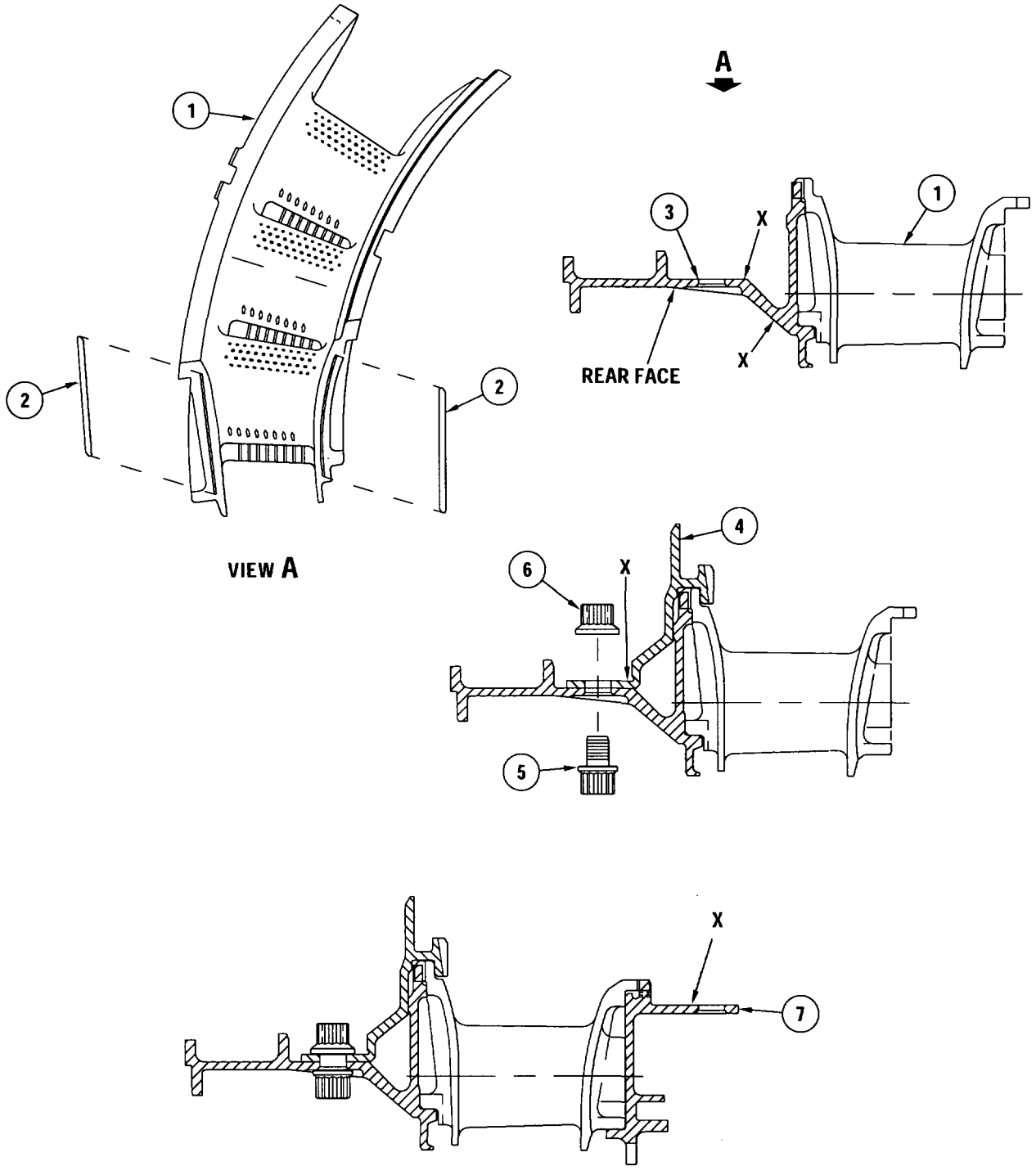
Key to Figure 408

1. First-stage HP Turbine Vane
2. Inner Turbine Vane Air Seal
3. First-stage HP Turbine Vane Shroud
4. DELETED
5. First-stage HP Turbine Vane Shroud
6. Bolt (Slave)
7. Turbine Retaining Plate
8. Nut (Slave)
9. Outer Turbine Vane Air Seal
10. Turbine Stator Seal Assembly



C31510

Assembly of First-stage HP Turbine Vane (Pre-SB24174)
Figure 408 (Sheet 2)

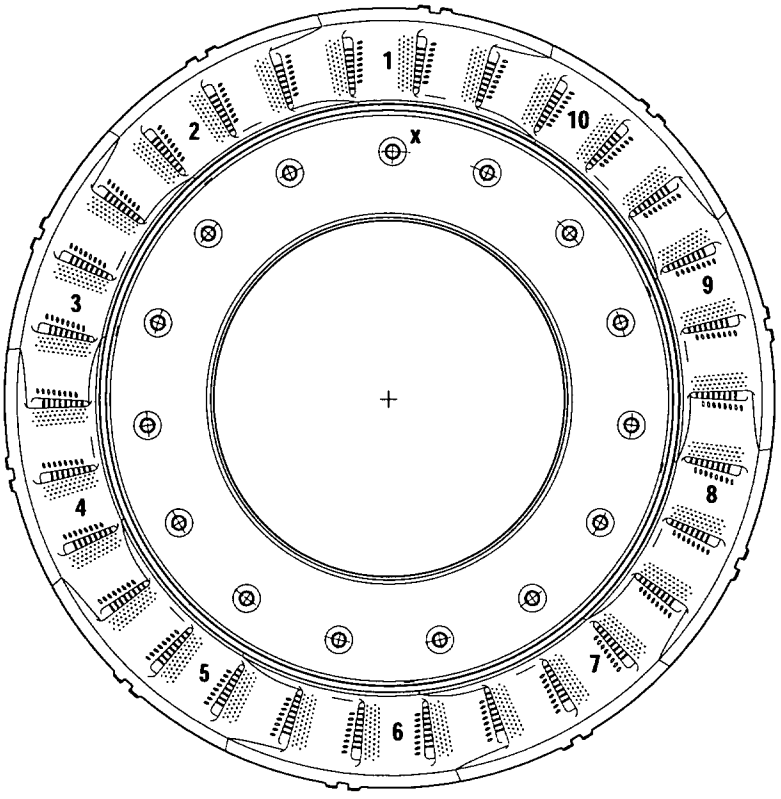


C84559

Assembly of First-stage HP Turbine Vane (Post-SB24174 and (Post-SB24490 or Post-SB24516))
Figure 409 (Sheet 1 of 2)

Key to Figure 409

1. First-stage HP Turbine Vane Segments
2. Turbine Vane Air Seal
3. Turbine Stator Seal
4. First-stage HP Turbine Vane Shroud
5. Bolt (Slave)
6. Nut (Slave)
7. First-stage HP Turbine Vane Shroud
8. Combustion Liner Rear Seal Support Assembly
9. Bolt



C84581

Assembly of First-stage HP Turbine Vane (Post-SB24174 and (Post-SB24490 or Post-SB24516))
Figure 409 (Sheet 2)

(16) Install primary and secondary fuel nozzle/manifold assemblies in combustion chamber case assembly (Ref. 73-10-04).

B. Installation of Combustion Chamber Liner In Combustion Chamber Outer Case (Post-SB24490 or Post-SB24516) (Ref. Fig. 410)

(1) Install combustion chamber outer case assembly (3) on base (4) on bench.

(2) Lift combustion chamber liner (1) and put it in combustion chamber outer case assembly (3) aligning igniter bosses (5).

(3) Install three locators (2) at 120 degrees apart in the fuel nozzle holes.

10. Combustion Chamber Outer Case Assembly - Installation

A. Procedure (Ref. Fig. 401)

(1) Put upper bypass duct bracket assembly (2) on combustion chamber outer case (8) with offset hole at top. Identify bracket securing bolt hole positions, on flange H, using an approved marker. Remove bracket assembly.

(2) Put lower bypass duct bracket assembly (7) on combustion chamber outer case (8) with bottom center tab aligned with combustion chamber drain. Identify bracket securing bolt hole positions, on Flange H, using an approved marker. Remove bracket assembly.

(3) Install lifting sling (4) (PWC43022) on combustion chamber outer case assembly (8). Put lifting arm in line with offset hole at top centre. Attach hoist and lift combustor assembly.

(4) Heat the rear flange of the turbine disk air nozzle support, on the gas generator case, for 15 minutes using a suitable heat gun.

(5) Remove slave nuts and bolts from turbine disk air nozzle (14).

(6) Bolts (6) must be new or freshly treated with anti-galling compound per. (PWA586). If required treat as follows:

WARNING: READ MATERIAL SAFETY DATA SHEET PRIOR TO USING CONSUMABLE MATERIAL.

(7) Degrease bolts (Per. PWA36603).

(a) Apply one even coat of anti-galling compound (PWC06-032) to the threaded portion of bolts using a brush or swab.

WARNING: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(b) Bake treated bolts in oven at 500-600°F for 30 minutes.

CAUTION: DO NOT PUSH ON BOLTS (6). THIS CAN CAUSE CLINCH-NUTS IN GAS GENERATOR CASE TO BE PUSHED OUT.

(8) Install combustion chamber case assembly (8) as follows:

(a) Move combustion chamber case assembly into position aligning the offset holes on flange H and turbine disk air nozzle assembly (14).

(b) Install and tighten 32 bolts (12) and self-locking nuts (9) and 15 bolts (6), evenly in a star pattern on combustor Flange H.

(c) Pre-SB24490 or Pre-SB24516: Make sure first-stage HP turbine stator is fully seated. Use drift (PWC43282) and soft faced hammer if necessary.

(d) Allow assembly to cool to room temperature.

(e) Torque bolts (6) in star pattern (72-50-01, Fits and Clearances REF. NO. 1704).

CAUTION: DO NOT LUBRICATE THREADS.

(9) Install four jacking insert blanking plates (3) on Flange H at locations A with eight self-locking nuts (9) and bolts (10).

CAUTION: DO NOT LUBRICATE THREADS.

(10) Install remaining 30 bolts (12) and self-locking nuts (9) in all unmarked bolt holes on Flange H. Torque all nuts (9) 62 to 72 lb.in. (7.0-8.0 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(11) Align offset hole and install upper bypass duct bracket assembly (2) on combustion chamber outer case. Secure with eleven self-locking nuts (9) and bolts (11) at location B. Torque 62 to 72 lb.in. (7.0-8.0 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(12) Install lower bypass duct bracket assembly (7) with bottom center tab aligned with combustion chamber drain. Secure using nine self-locking nuts (9) and bolts (11), at location B. Torque 62 to 72 lb.in. (7.0-8.0 Nm).

11. Engine Assembly

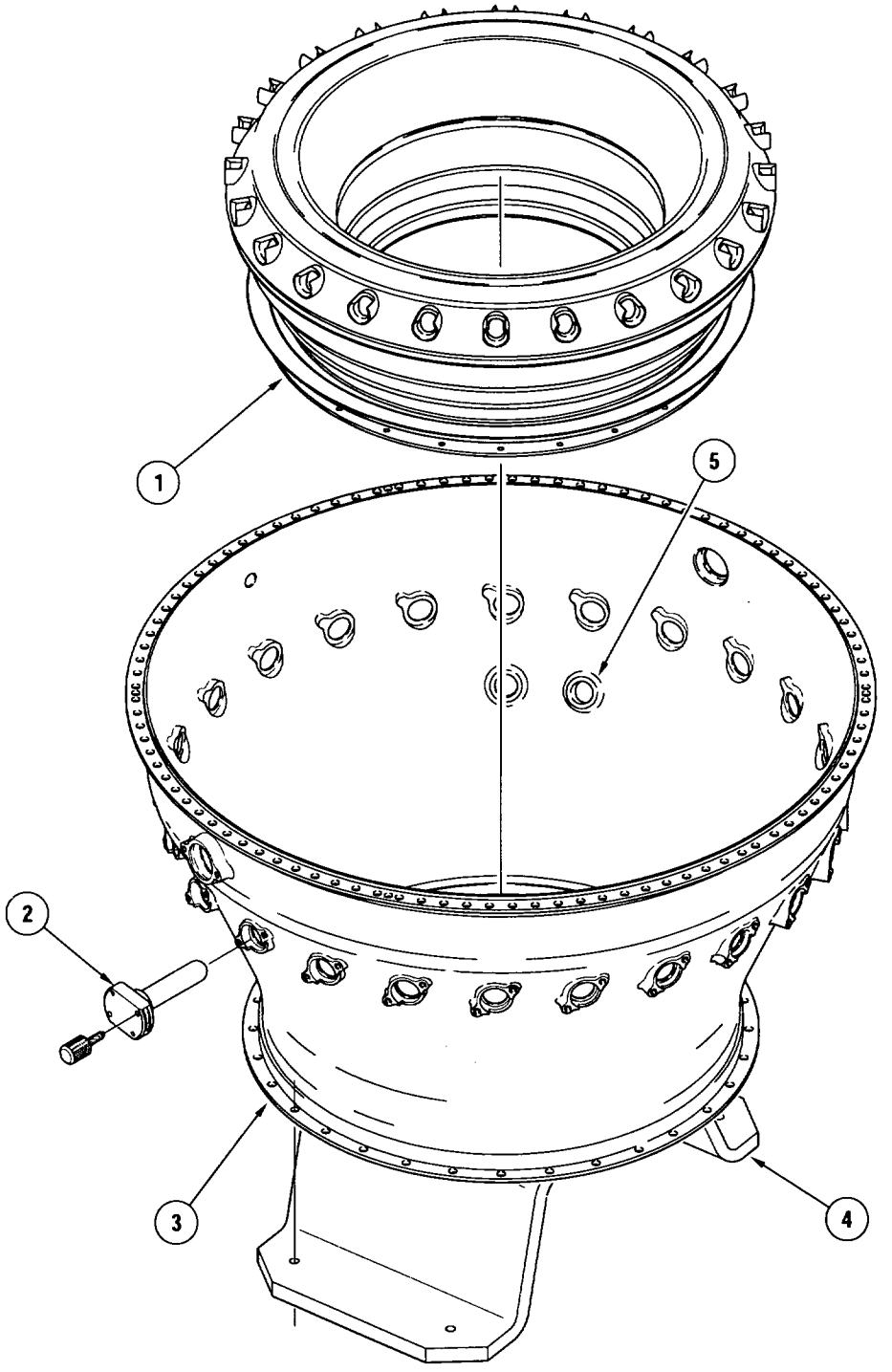
A. Assembly of Engine After Combustor Installation

(1) Install HP turbines(Ref. 72-50-01).

(2) Install cabin bleed air tubes in the combustion case (Ref. 75-10-02).

(3) Install fuel drain valve adapter and transfer tube in bottom of outer bypass duct (Ref. 72-70-01 and 73-10-05).

(4) Install gasket (6) and tube adapter (7) to chamber outer case (4). Torque adapter 90 to 100 lb.in. (11.3-10.2 Nm) and lockwire (PWC05-089).



C68342

Removal/Installation of Combustion Chamber Liner Assembly (Post-SB24490 or Post-SB24516)
Figure 410

Key to Figure 410

1. Combustion Chamber Liner Assembly
2. Locator (PWC43572) or (PWC61148)
3. Combustion Chamber Outer Case Assembly
4. Base (PWC60763)
5. Igniter Bosses

(5) Install primary fuel tube assembly (Ref. 73-10-04).

(6) Install lower inner bypass duct assemblies (Ref. 72-70-01).

(7) Install, inner and outer upper bypass ducts (Ref. 72-70-01).

(8) Install LP turbine module (Ref. 72-50-02).

(9) Install exhaust case (Ref. 72-50-03).

(10) Install rear lower fairing assembly in bottom of outer bypass duct (Ref. 72-70-01).

COMBUSTOR - INSPECTION/CHECK

1. General

   A. This section provides instructions and limits, required to perform visual bench check/inspection of the Combustion Chamber Outer Case, Combustion Chamber Liner, Fuel Nozzles and Igniter Plugs.

      NOTE: These inspection procedures can only be performed during Heavy Maintenance.

   B. It is recommended that a magnifying glass of at least 10X power be used when visually inspecting for damage.

   C. Within the following text, where the term nicks or dents is used, unless otherwise specified, blend repair limits are applicable provided at least 70 percent of original surface remains undamaged.

   D. Parts found unsuitable for further engine running should be replaced. Rejected parts should be returned to Pratt & Whitney Canada for complete inspection and possible repair/refurbishment.

2. Consumable Materials

   Not Applicable

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Combustion Chamber Outer Case Assembly (Ref. Fig. 601)

   A. Visual Check

      (1) Inspect for cracks. No cracks permitted.

      (2) Inspect for nicks or dents. Maximum of 15 acceptable to a depth of 0.003 inch (0.08 mm) provided damage is removed by blending to a maximum depth of 0.005 inch (0.13 mm) and separated by a minimum distance of 0.250 inch.

      (3) Inspect igniter boss thread for damage. Minor damage may be removed by blending.

      (4) Check for loose, broken or damaged jacking inserts and helical coil inserts. Replace as necessary (Ref. 70-00-00, STANDARD PRACTICES).

P&WC Proprietary Information. Subject to the restrictions on the title page.

6. Combustion Chamber Liner

A. Visual Check

(1) Inspection of combustion chamber liners, on engines that were removed due to unscheduled maintenance, may be carried out with the liner installed (Ref. Chapter 72-00-00, ENGINE, GENERAL - INSPECTION, Table 606).

(2) Inspection of combustion chamber liners, on engines that were removed due to scheduled maintenance (HSI), inspect in accordance with Table 601, below.

TABLE 601, Combustion Chamber Liner Inspection

Inspection Criteria	Acceptable Limits - Continue in Service
OUTER LINER PANEL Pre-SB24490 **OUTER LINER Post-SB24490**	
FUEL NOZZLE BOSSES	
Cracks	- Width of each crack is not more than 0.030 inch. - Extension of any crack can extend up to 180° around fuel nozzle boss.
Fretting	- Acceptable up to an average depth of 0.005 inch maximum, and a local depth of 0.010 inch maximum.
IGNITER BOSSES	
Cracks	- Width of each crack is not more than 0.030 inch. - Extension of any crack can extend up to 180° around igniter bosses.
Fretting wear on floating collars	- Permitted up to an average depth of 0.005 inch maximum, and a local depth of 0.010 inch maximum on inner diameter. - Local fretting wear on antirotation tang and bracket up to 0.100 inch maximum. If exceeded, local weld repair is permitted.
SEAM WELDS	
Cracks	- Width of each crack is not more than 0.030 inch. - Length of each crack is not more than 6.00 inches.
PLASMA COATING LOSS	
	- Multiple areas of coating loss, up to 1.00 inch by 1.00 inch, that may be associated with oxidation and shallow buckling.
OTHER AREAS	

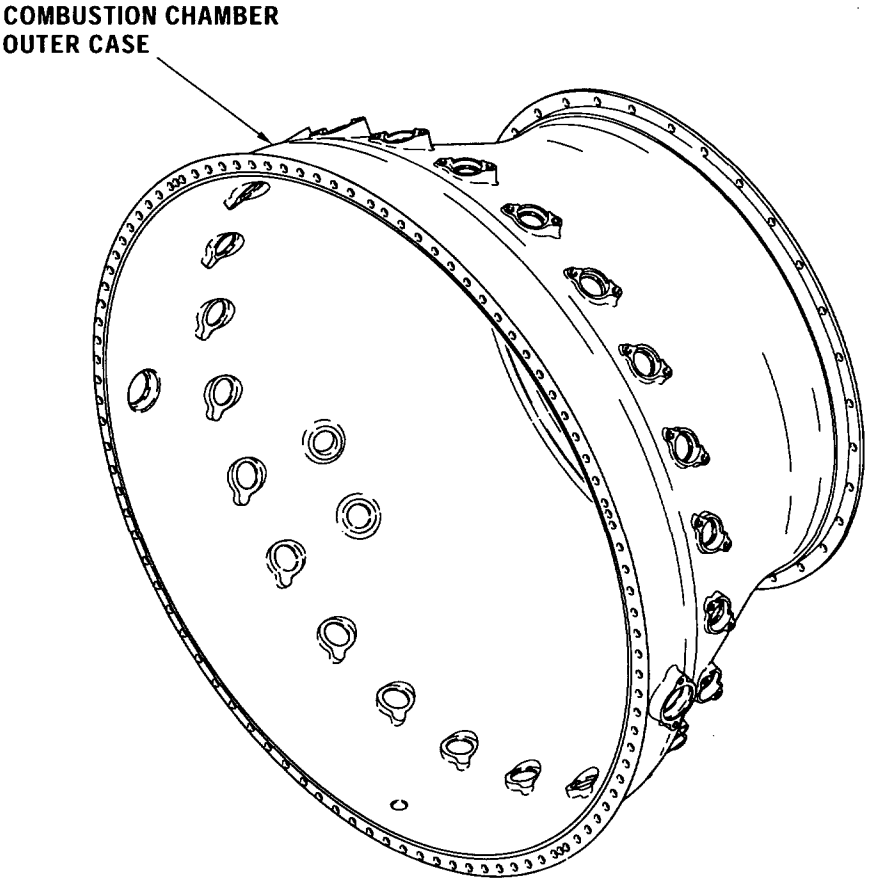
TABLE 601, Combustion Chamber Liner Inspection (Cont'd)

Inspection Criteria	Acceptable Limits - Continue in Service
Cracks	- Any number of non-converging cracks, up to 0.600 inch long, and less than 0.020 inch wide. Maximum of four cracks, up to 1.00 inch long and 0.020 inch wide.
Post-SB24490 Only	- Circumferential cracks between primary fuel nozzle smoke holes that may be combined with axial cracks propagating towards combustion liner mating flange, providing the cracks do not extend into the mating flange.
COOLING RINGS and V-BAND Pre-SB24444	
Cracks between cooling holes	- Any number of axial cracks combined with circumferential cracks, provided the cracks do not form a closing pattern, with potential for material loss. - Maximum of two circumferential cracks, up to 2.00 inches long and 0.040 inch wide.
COOLING RINGS and V-BAND with THUMBNAIL SCOOPS Post-SB24444	
Oxidation and material loss	- Thumbnail oxidation and material loss is acceptable, provided the V-band holes are not exposed. Partial exposure of V-band holes is acceptable over localized areas.
Cracks between cooling holes	- Any number of axial cracks combined with circumferential cracks, provided they do not form a closing pattern, with potential for material loss.
OUTER BAFFLE and LIP ASSEMBLY Pre-SB24490	
Buckling	- Shallow buckling with no sudden kink is acceptable.
Cracks	- Circumferential cracks up to 1.0 inch long are acceptable except in the flange area. - Inspect self locking nut condition and security. Replace if lose or damaged.
EXIT LIP Post-SB24490	

TABLE 601, Combustion Chamber Liner Inspection (Cont'd)

Inspection Criteria	Acceptable Limits - Continue in Service
Oxidation	- Oxidation damage at the outer liner exit lip, in line with the leading edge of all HPT vane airfoils, provided the damage is within 0.150 inch axial depth and 0.350 inch circumferential width. - Fretting is acceptable at inner diameter, provided it does not exceed 20% wall thickness and 20% of circumference.
INNER LINER PANEL Pre-SB24490 **INNER LINER Post-SB24490**	
PLASMA COATING LOSS	
	- Multiple areas of coating loss, up to 1.00 inch by 1.00 inch area, that may be associated with shallow buckling and multi-pronged cracks.
SEAM WELDS	
Cracks	- Cracks up to 6.00 inches long and 0.030 inch wide are acceptable.
COOLING RINGS and V-BAND	
Cracks between cooling holes	- Any number of axial cracks combined with circumferential cracks, provided cracks do not form a closing pattern, with potential for material loss.
INNER BAFFLE **(Non-gas path area)**	
Cracks	- Circumferential cracks up to eight inches long are acceptable if stop-drilled. - One circumferential crack less than 8 inches long, combined with an axial crack, and extending to the lip, is acceptable.
EXIT LIP	
Oxidation	- Oxidation damage at the outer liner exit lip, in line with the leading edge of all HPT vane airfoils, provided the damage is within 0.150 inch axial depth and 0.350 inch circumferential width.

NOTE: If damage is more than limits specified, record the extent of damage and submit this information to Pratt & Whitney Canada for review. If replacement of the liner is required, P&WC may recommend limited contingency engine operation for the purpose of obtaining flight permission from the operator's regulatory authority.



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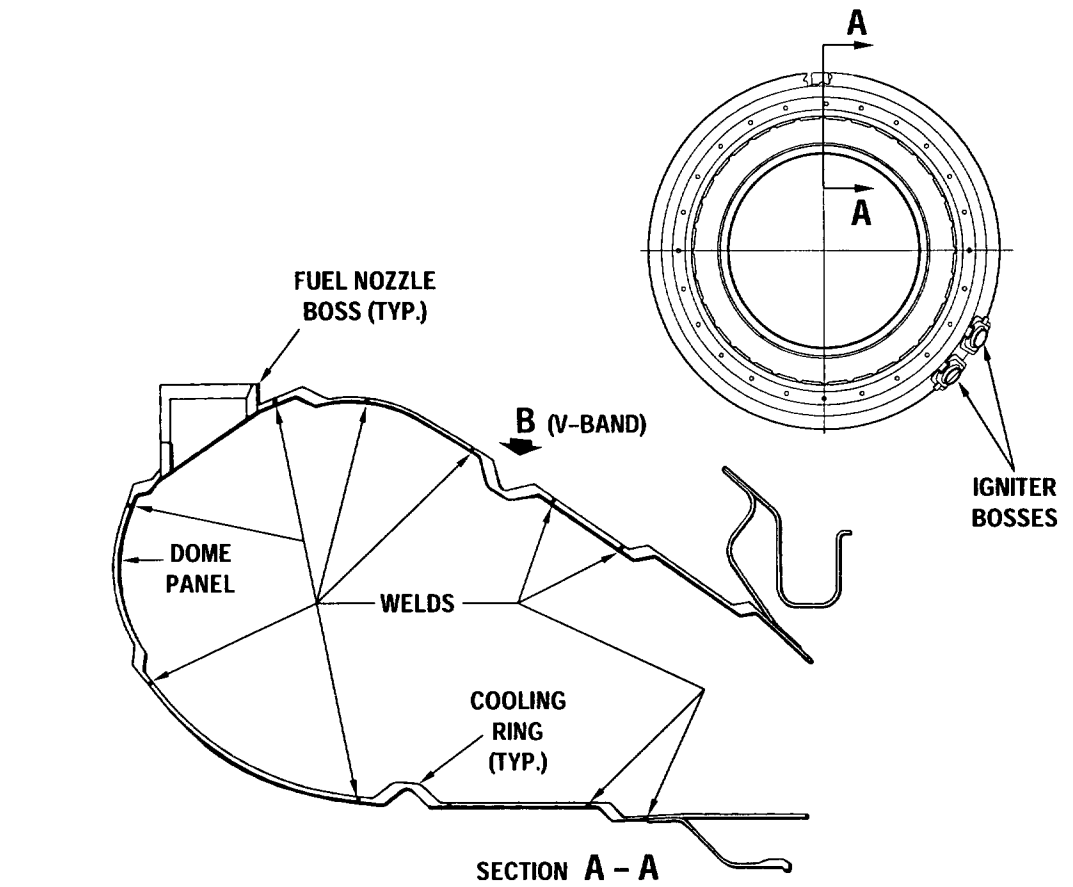
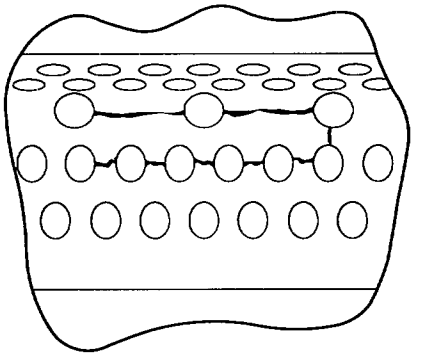
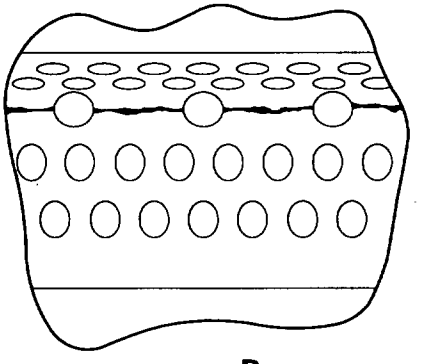
Combustion Chamber Outer Case - Inspection
Figure 601





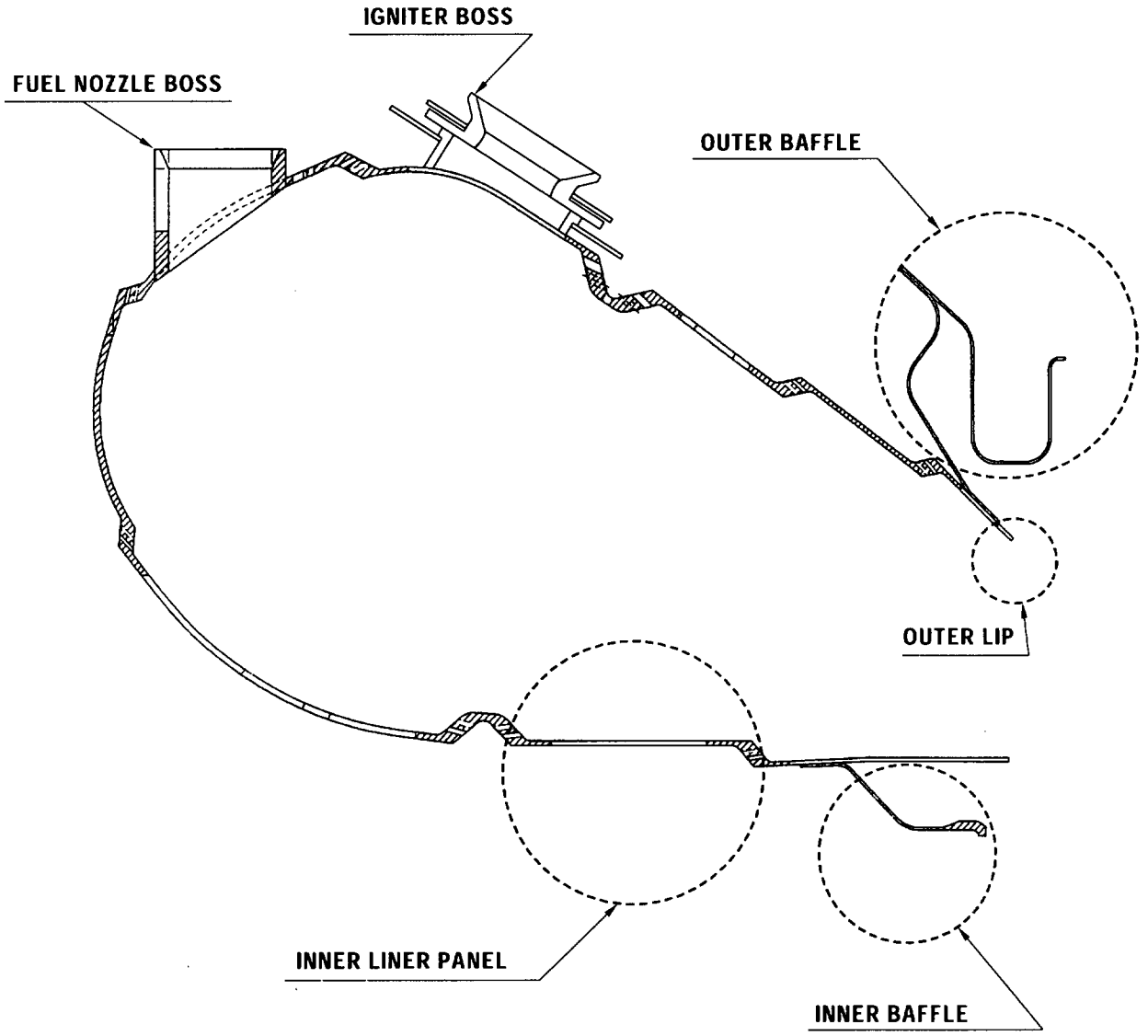
VIEW B
UNACCEPTABLE CRACKS.
CONVERGING CRACKS WITH
POTENTIAL FOR MATERIAL LOSS
ARE NOT ACCEPTABLE.



VIEW B
ACCEPTABLE CRACKS.
SINGLE OR MULTIPLE CRACKS
THRU UP TO 6 INCHES LONG
(APPROX. 30 HOLES) IN V-BAND
AREA ARE ACCEPTABLE.

C19128B

Combustion Chamber Liner - Inspection (SB24365)
Figure 602 (Sheet 1 of 2)



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Combustion Chamber Liner - Inspection (SB24365)
Figure 602 (Sheet 2)

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Combustion Chamber Liner - Scheduled HSI
Figure 603 (Sheet 1 of 2)

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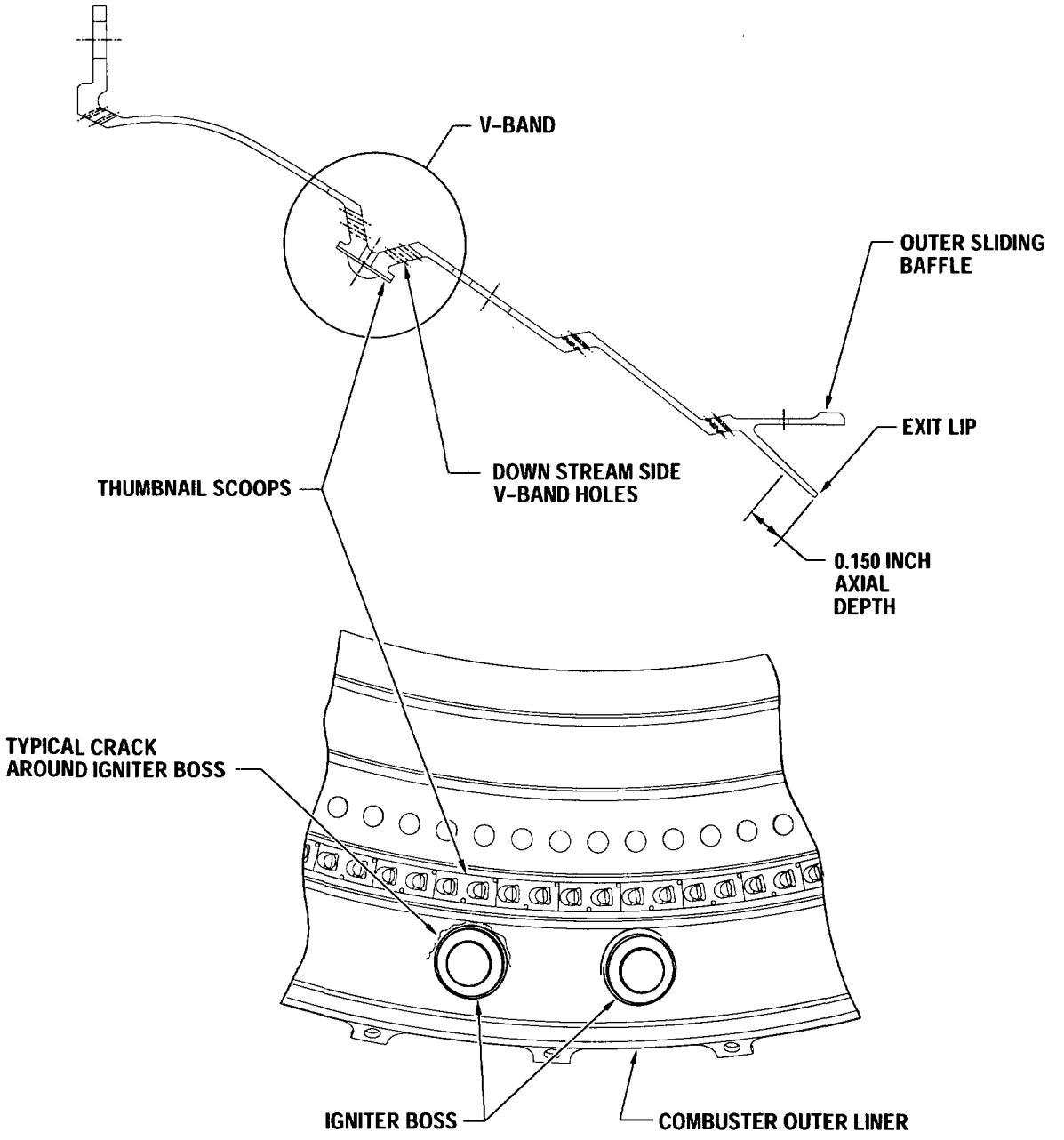
Combustion Chamber Liner - Scheduled HSI
Figure 603 (Sheet 2)



Post-SB24490 C92987

Combustion Chamber Liner - Inspection
Figure 604 (Sheet 1 of 5)

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Post-SB24490

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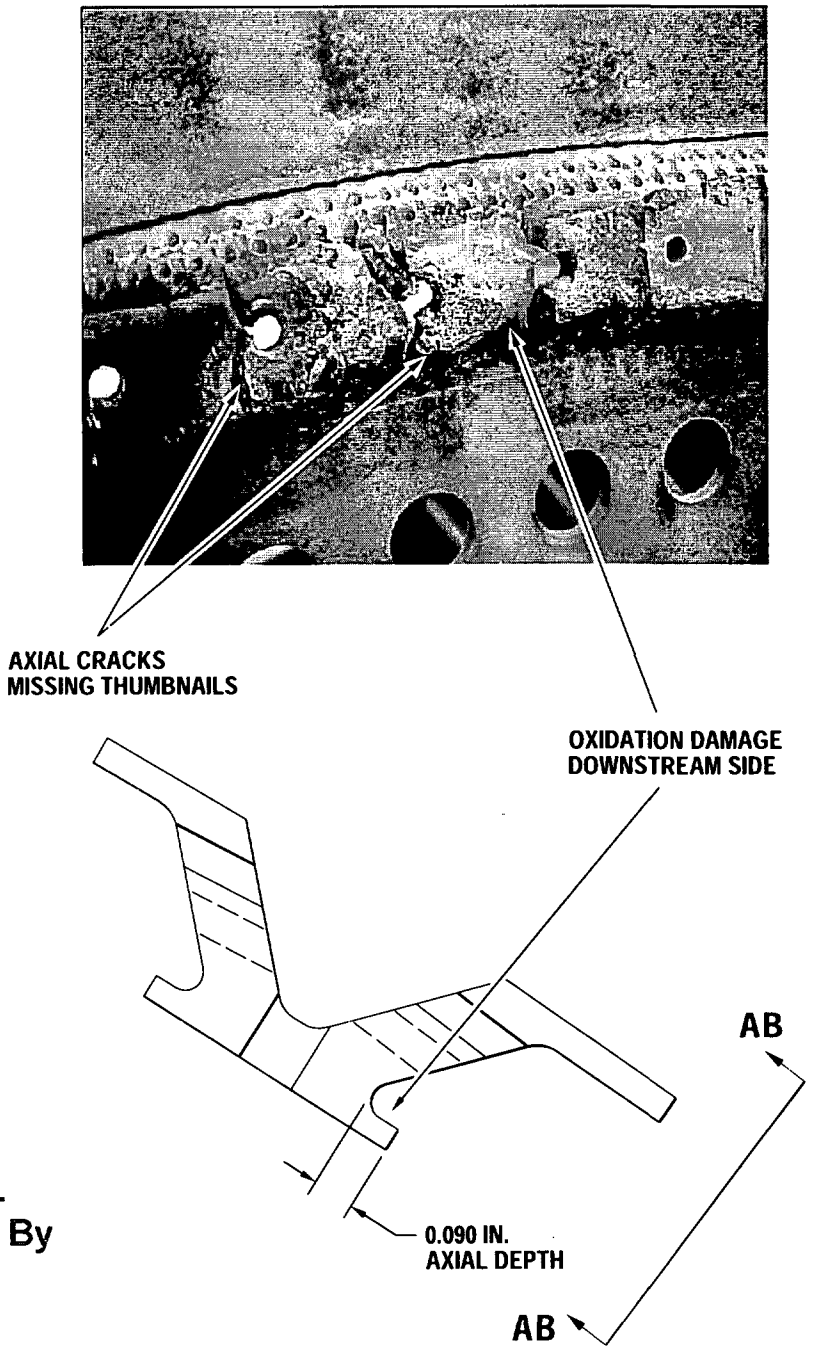
Combustion Chamber Liner - Inspection
Figure 604 (Sheet 2)

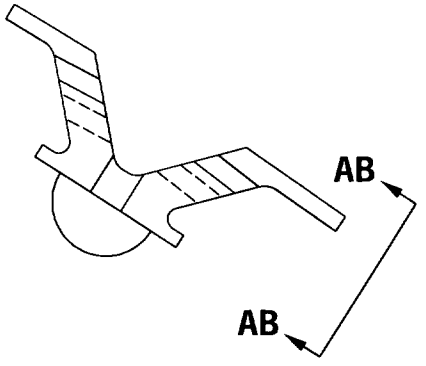


ORIGINAL
As Received By
ATP

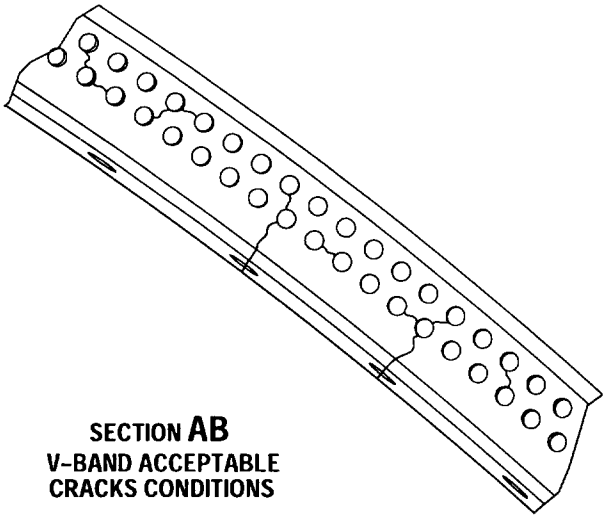
Post-SB24490

C92989

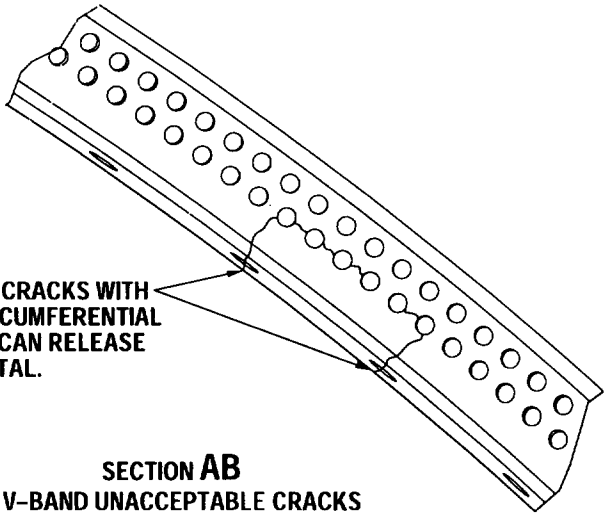
Combustion Chamber Liner - Inspection
Figure 604 (Sheet 3)



V-BAND



SECTION AB
V-BAND ACCEPTABLE
CRACKS CONDITIONS

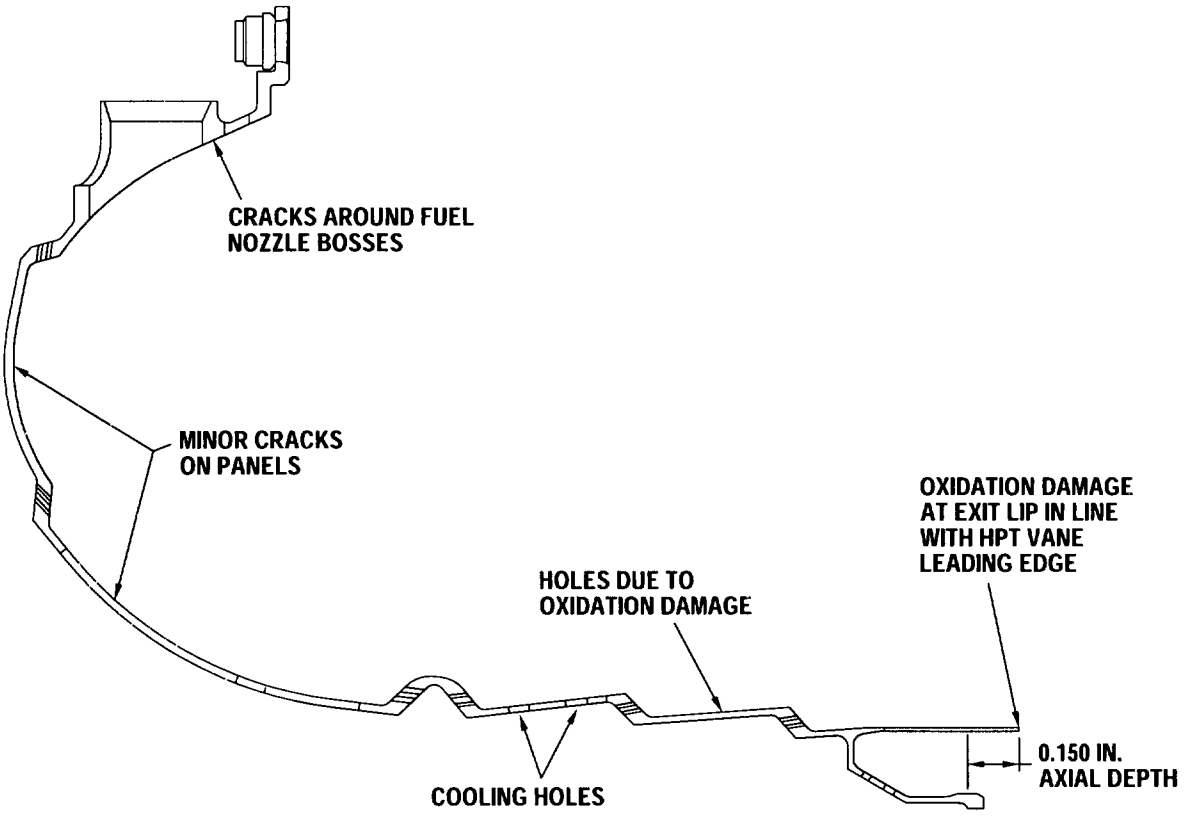


SECTION AB
V-BAND UNACCEPTABLE CRACKS

Post-SB24490

C98591

Combustion Chamber Liner - Inspection
Figure 604 (Sheet 4)


CRACKS AROUND FUEL NOZZLE BOSSES
MINOR CRACKS ON PANELS
OXIDATION DAMAGE AT EXIT LIP IN LINE WITH HPT VANE LEADING EDGE
HOLES DUE TO OXIDATION DAMAGE
0.150 IN. AXIAL DEPTH
COOLING HOLES

COMBUSTOR INNER LINER

Post-SB24490 C98588

Combustion Chamber Liner - Inspection
Figure 604 (Sheet 5)

TABLE OF CONTENTS

SUBJECT	PAGE
TURBINE SECTION- DESCRIPTION AND OPERATION	**72-50-00**
1. HP Turbine Housing, First and Second-stage HP Turbine Stators)	1
2. HP Turbine Rotor Balancing Assembly)	1
3. LP Turbine Module)	3
4. Turbine Exhaust Case and No. 4 Bearing Housing)	5
HP TURBINE - REMOVAL/INSTALLATION	**72-50-01**
1. General	401
2. Consumable Materials	401
3. Special Tools	401
4. Fixtures, Equipment and Supplier Tools	403
5. Second-stage HP Turbine Disk	403
A. Removal of HP Turbine Nut	403
B. Removal of HP Turbine Disk	407
6. First-stage HP Turbine Disk	408
A. Removal	408
7. Separatation of HP Turbine from Shroud Housing	408
A. Procedure	408
8. Replacement of HP Turbine	409
A. HP Turbine Trim Balance Weight Replacement	409
9. HP Turbine Housing and Second-stage Turbine Stator	409
A. Disassembly	409
10. First-stage HP Turbine Vane Assembly	413
A. Removal of First-stage HP Turbine Vane Assembly	413
B. Disassembly of First-stage HP Turbine Vane Assembly (Pre-SB24174)	415
C. Disassembly ofFirst-stage HP Turbine Vane Assembly (Post-SB24174)	415

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
HP TURBINE - REMOVAL/INSTALLATION (Cont'd)	**72-50-01**
D. Disassemble First-stage HP Turbine Vane Assembly (Post-SB24490)	415
E. Assembly of First-stage HP Turbine Vane (Pre-SB24174)	417
F. Assembly of First-stage HP Turbine Vane (Post-SB24174)	419
G. Assemble First-stage HP Turbine Vane (Post-SB24490)	421
11. No. 3 Bearing Rear Cover and Carbon Seal	432
A. Removal	432
12. No. 3 Bearing Carbon Seal and Rear Cover Assembly	433
A. Installation of Carbon Seal in No. 3 Bearing Rear Cover	433
B. Installation of No. 3 Bearing Rear Cover Assembly	433
13. HP Turbine Rotor Air Seal	435
A. Installation of HP Turbine Rotor Air Seal	435
14. HP Turbine Housing Assembly - Refurbishment	437
A. Measure the Circular Runout at Flange E	437
B. Installation of Baffle	439
C. Machining of Second-stage Turbine Stator Assembly (Post-SB24135 or Post-SB24419)	439
D. Installation of Post-SB24419 Second-stage Turbine Stator Assembly	440
E. Calculation of Class of Second-stage Shroud Segments	442
F. Calculation of Class of First-stage Shroud Segments	447
G. Preparation for Installation of HP Turbine Shroud Segments	447
H. Assembly of HP Turbine Housing for Grinding	449
I. Installation of Baffle	451
J. Grinding of HP Turbine Shroud Segments	451
K. Disassembly After Grinding	453

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
HP TURBINE - REMOVAL/INSTALLATION (Cont'd)	**72-50-01**
L. Preparation for Final Assembly	455
M. Assembly of HP Turbine Housing	456
15. HP Turbine Spacer	456
A. Calculation HP Turbine Spacer Thickness	456
B. Grinding of Spacer	460
16. HP Turbine Trim Balancing	462
A. Installation of Trim Balance Weights	462
17. First-stage HP Turbine	463
A. Installation	463
18. HP Turbine Housing	463
A. Installation	463
19. Second-stage HP Turbine	463
A. Installation	463
20. HP Turbine Module Installation	463
A. Assemble HP Turbine Module	463
21. HP Turbine Module Lifting Adapter Installation	467
A. HP Turbine Module Lifting Adapter Installation	467
22. HP Turbine Module Installation	471
A. HP Turbine Module Installation	471
B. Installation of HP Turbine Retaining Nut (Alternate)	478
C. Dummy HP Turbine nut Procedure	479
HP TURBINES - INSPECTION/CHECK	**72-50-01**
1. General	601
2. Consumable Materials	601
3. Special Tools	601

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
HP TURBINES - INSPECTION/CHECK (Cont'd)	**72-50-01**
4. Fixtures, Equipment and Supplier Tools	601
5. First-stage HP Turbine Disk Assembly	601
A. Visual Check of Turbine Disk	605
B. Visual Check of Front and Rear HP Turbine Covers	605
C. Visual Check of Turbine Blades	605
6. Second-stage HP Turbine Disk Assembly	607
A. Turbine Disk Assembly Inspection	607
7. HPT Shroud Housing Assembly	610
A. Visually Check HP Turbine Baffle	610
B. Visual Check of HP Turbine Housing	610
C. Visual Check of First and Second-stage HP Turbine Shroud Segments	612
D. Visual Check of First and Second-stage Shroud Retaining Rings	612
8. First and Second-stage Stator Seal Rings	612
A. Visual Checks	612
9. Turbine Vane Retaining Plate	612
A. Visual Checks	612
10. First-stage HP Turbine Vane Assembly (Pre-SB24174)	613
A. Visual Check of Inner and Outer First-stage Vane Shrouds	613
B. Visual Check of Vane Retaining Plate	613
C. Visual Check of First-stage Stator Air Seal	613
D. Visual Check of First-stage Vane Seal Ring	613
11. HP Turbine Vane Ring Segments	613
A. Visual Checks	615
12. Second-stage Turbine Vane Ring Assembly	621

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
HP TURBINES - INSPECTION/CHECK (Cont'd)	**72-50-01**
A. Stator Air Seal	621
B. Vane Ring Assembly	624
13. Turbine Disk Air Nozzle Assembly	625
A. Visual Check	625
14. HP Turbine Spacer	632
A. Visual Check	632
15. High Turbine Rotor Air Seal	632
A. Visual Check	632
16. No. 3 Bearing Rear Cover Assembly	632
A. Visual Check	632
17. First-stage HPT Shroud Segments	632
A. Visual Checks	632
18. Second-stage HPT Shroud Segments	636
A. Visual Checks	636
19. First and Second-stage Shoud Retaining Rings	638
A. Visual Checks	638
B. Dimensional check	638
20. Fits, Clearances and Torque Loadings	638
LP TURBINE MODULE - REMOVAL/INSTALLATION	**72-50-02**
1. General	401
2. Consumable Materials	401
3. Special Tools	401
4. Fixtures, Equipment and Supplier Tools	402
5. No. 4 Bearing and Related Parts	402
A. Removal	402

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
LP TURBINE MODULE - REMOVAL/INSTALLATION (Cont'd)	**72-50-02**
B. Installation	403
6. LP Turbine Module	406
A. Removal	406
B. Installation	407
LP TURBINE MODULE - INSPECTION/CHECK	**72-50-02**
1. General	601
2. Consumable Materials	601
3. Special Tools	601
4. Fixtures, Equipment and Supplier Tools	601
5. LP Turbine Case	601
A. Visual Check	601
6. LP Turbine Seal Rings	601
A. Visual Checks	601
7. Third-stage Vane Assembly	602
A. Visual Check	602
8. Fourth-stage Disk, Blades and Vanes	608
A. Visual Check of Fourth-stage Disk Hub	608
B. Inspect Fourth-stage Blades and Vanes Using Borescope	608
9. Fifth-stage Disk, Blades and Vanes	610
A. Visual Check of Fifth-stage Blades and Vanes	610
B. Visual Check of Fifth-stage Disk	610
10. Fits, Clearances and Torque Loadings	612
EXHAUST CASE - REMOVAL/INSTALLATION	**72-50-03**
1. General	401
2. Consumable Materials	401

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
EXHAUST CASE - REMOVAL/INSTALLATION (Cont'd)	**72-50-03**
3. Special Tools	401
4. Fixtures, Equipment and Supplier Tools	401
5. Externals	402
A. Removal	402
6. Exhaust Case	402
A. Removal of Exhaust Case	402
B. Disassembly of Exhaust Case	403
C. Assembly of Exhaust Case	403
D. Assembly of No. 4 Bearing Seal Carrier	405
E. Installation of No. 4 Bearing Seal Carrier	409
F. Installation of Exhaust Case	409
7. No. 4 Bearing Carbon Seal	411
A. Removal	411
8. Fuel Shut-off Mechanism and Exhaust Cone	413
A. Installation	413
EXHAUST CASE ASSEMBLY- INSPECTION/CHECK	**72-50-03**
1. General	601
2. Consumable Materials	601
3. Special Tools	601
4. Fixtures, Equipment and Supplier Tools	601
5. Turbine Exhaust Case Assembly)	601
A. Visual Check of Case	601
B. Visual Check of Rear Fairing	603
6. Inner Cone and Shield	603
A. Inner Cone)	603

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
EXHAUST CASE ASSEMBLY- INSPECTION/CHECK (Cont'd)	**72-50-03**
B. Cone Shield)	603
7. Fits, Clearances and Torque Loadings	603
A. General	603
B. Dimensional Checks	605
C. Torque Limits	605

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Feb 27/2009
	2	Feb 27/2009
	3	Feb 27/2009
	4 blank	Feb 27/2009
Contents	1	Feb 27/2009
	2	Feb 27/2009
	3	Feb 27/2009
	4	Feb 27/2009
	5	Feb 27/2009
	6	Feb 27/2009
	7	Feb 27/2009
	8	Feb 27/2009
72-50-00	1	Nov 19/99
Description and	2	Nov 19/99
Operation	3	Nov 19/99
	4	Nov 19/99
	5	Nov 19/99
	6	Nov 19/99
72-50-01	401	Feb 27/2009
Removal/	402	Feb 27/2009
Installation	403	Feb 27/2009
	404	Feb 27/2009
	405	Feb 27/2009
	406	Feb 27/2009
	407	Feb 27/2009
	408	Feb 27/2009
	409	Feb 27/2009
	410	Feb 27/2009
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	458	Feb 27/2009
	459	Feb 27/2009
	460	Feb 27/2009
	461	Feb 27/2009

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
	462	Feb 27/2009
	463	Feb 27/2009
	464	Feb 27/2009
	465	Feb 27/2009
	466	Feb 27/2009
	467	Feb 27/2009
	468	Feb 27/2009
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72-50-01 Inspection Check	601	Feb 27/2009
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	657	Feb 27/2009
	658	Feb 27/2009
	659	Feb 27/2009
	660	Feb 27/2009

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
	661	Feb 27/2009
	662	Feb 27/2009
	663	Feb 27/2009
	664 blank	Feb 27/2009
72-50-02 Removal/ Installation	401	Feb 27/2009
	402	Feb 27/2009
	403	Feb 27/2009
	404	Feb 27/2009
	405	Feb 27/2009
	406	Feb 27/2009
	407	Feb 27/2009
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	409	Feb 27/2009
	410	Feb 27/2009
	411	Feb 27/2009
	412	Feb 27/2009
72-50-02 Inspection Check	601	Nov 09/2007
	602	Nov 09/2007
	603	Nov 09/2007
	604	Nov 09/2007
	605	Nov 09/2007
	606	Nov 09/2007
	607	Nov 09/2007
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72-50-03 Removal/ Installation	401	Feb 27/2009
	402	Feb 27/2009
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72-50-03 Inspection Check	601	Nov 19/99
	602	Nov 19/99
	603	Nov 19/99
	604	Nov 19/99
	605	Nov 19/99
	606	Nov 19/99
	607	Nov 19/99
	608	Nov 19/99
	609	Nov 19/99
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TURBINE SECTION- DESCRIPTION AND OPERATION

1. HP Turbine Housing, First and Second-stage HP Turbine Stators (Ref. Fig. 1)

The HP turbine housing is a cylindrical nickel-alloy forging, machined to accommodate the second-stage (HP) turbine vane ring, and first and second-stage shroud segment assemblies. A flange on the outside diameter supports the housing at Flange E, sandwiched between the combustion chamber outer case and the low pressure turbine module.

The first-stage HP turbine stator assembly comprises 32 individually cast nickel-alloy vane segments held in place by inner and outer machined nickel-alloy shroud rings. The stator assembly is located between the combustion chamber liner exit and the first-stage HP turbine. The vanes ensure that the expanding gases are directed to the HP turbine blades at the proper angle to drive the turbine.

A flange on the front of the outer shroud supports the combustion chamber liner and a circular retaining plate for the vane segments. A circumferential groove on the rear of the outer shroud accommodates an interstage sealing ring, while 32 slots equally spaced around the shroud allow compressor delivery (P3) air to pass through the vanes for cooling. This cooling air passes through the vanes and exits into the gas path through slots in the airfoil leading and trailing edges.

The inner shroud locates the vane segments with lugs and a circumferential groove and is secured to the tangential on board injection nozzle assembly at its inside diameter.

The second-stage HP turbine vane ring consists of an integrally cast nickel-alloy vane ring having 59 vanes. The vanes ensure that the expanding gases are directed to the second-stage HP turbine blades at the optimum angle to drive the turbine. The outer platform has 18 lugs extended radially outwards to locate in slots machined in the shroud housing. The outside diameter has a circumferential groove which accommodates an interstage sealing ring.

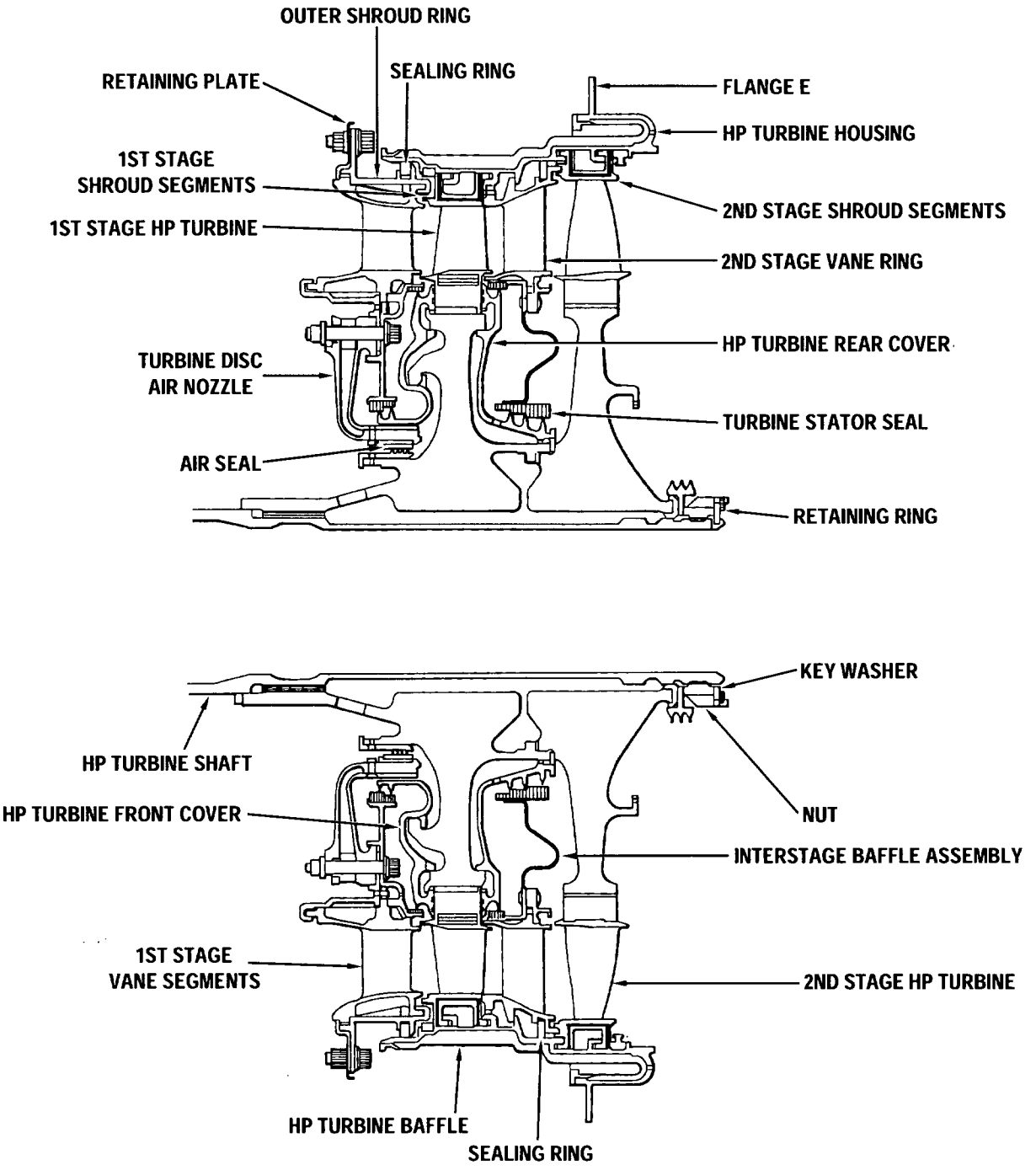
The interstage baffle assembly, interposed between the first and second-stage HP turbines, is riveted to the second-stage vane ring. The baffle directs secondary cooling air up the front face of the second-stage turbine disk.

Eighteen shroud segments for each of the first and second-stage HP turbines are seated in circumferential grooves in the stator housing and are held in position by retaining rings. The shroud segments act as a seal and provide running clearance for the HP turbine blades.

2. HP Turbine Rotor Balancing Assembly (Ref. Fig. 1)

The HP turbine rotor balancing assembly consists of a two-stage turbine assembly, held together by a lug and slot arrangement, mounted on the rear end of the balanced HP turbine shaft by means of an internal spline. The assembly is secured on the shaft by a spanner nut, keywasher and retaining ring. The first and second-stage disk and blade assemblies incorporate 39 and 54 nickel-alloy blades, respectively, and each blade is located in a fir-tree serration in the circumference of the turbine disks.

A cover, fitted to the front face of the first-stage disk, directs cooling air from the nozzle near the hub of the disk along the face of the disk, up through the blade roots and into the hollow turbine blades. Additionally, the cover retains the front of the first-stage blades and



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High Pressure (HP) Turbine Section
Figure 1

serves as the rotating portion of two labyrinth air seals. A similar cover, mounted on the rear of the first-stage disk, secures the rear of the blades and serves as the rotating portion of the interstage labyrinth air seal. The blades of the second-stage HP turbine are each secured to the disk by a rivet.

Each HP turbine disk incorporates a flange for disk balancing; the front flange is secured by a retaining ring to the first-stage disk, while the rear flange is an integral feature of the second-stage disk. The required number of classified weights and rivets is determined during initial assembly balancing.

3. LP Turbine Module (Ref. Fig. 2)

The LP turbine module consists of a three-stage turbine rotor balancing assembly and three stator assemblies with interstage baffles, contained in a nickel-alloy casing. The three stages are numbered with respect to the complete engine, i.e. third, fourth, and fifth-stage.

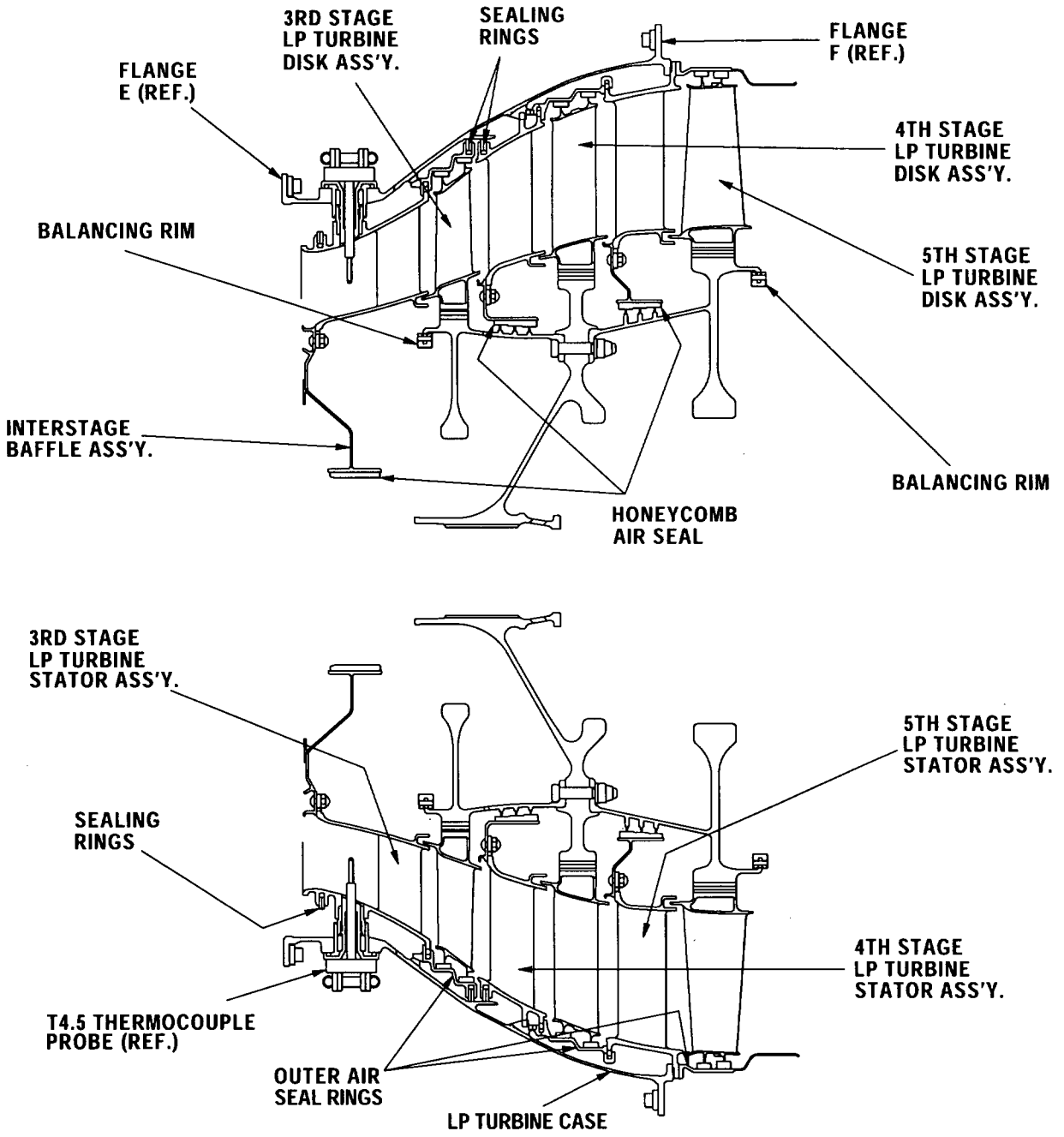
The LP turbine rotor balancing assembly consists of three nickel-alloy disks, each having fir-tree serrations machined in their outer circumferences. The serrations mount 76, 62 and 68 blades to the third, fourth and fifth-stage disks, respectively. Each blade has an integral tip shroud which forms part of a continuous ring when all blades are assembled to the disk. The blades are each retained in their disk by a rivet. The third and fifth-stage disks are bolted to the fourth-stage disk, which mounts on the LP compressor shaft by means of an internal spline. A balancing rim on the front of the third-stage disk and rear of the fifth-stage disk provides for balancing of the assembly, prior to installation on the shaft.

The third-stage LP turbine stator assembly consists of a 70-vane ring and a concentric nickel-alloy turbine interstage baffle assembly. A circumferential groove on the front of the outer platform accommodates two interstage sealing rings. Eight bosses radially disposed around the circumference contain sleeves which attach the stator assembly to the LP turbine case and locate T4.5 thermocouple probes in the gas path. The stator assembly mounts on the first-stage LP turbine outer air seal with lugs at the rear of its outer platform. An interstage baffle riveted to the front of the inner platform prevents dissipation of gas heat to the disk faces and incorporates a honeycomb stator air seal at its inner diameter.

The fourth-stage stator assembly comprises 71 vanes and is supported at the rear outer platform by the LP case. A circumferential groove at the front accommodates two sealing rings which close the gap between the stator outer platform and the LP case. An interstage baffle with a honeycomb stator air seal at its inner diameter is riveted to the front of the inner platform.

The fifth-stage stator assembly has 74 vanes and fits into the rear of the fourth-stage LP turbine outer air seal with lugs at the front of its outer platform. The rear of the stator assembly has locating lugs on the outer platform which locate in slots in the rear flange of the LP case (Flange F). An interstage baffle/air seal is riveted to the front of the inner platform.

The LP turbine case is a bell shaped welded assembly with front and rear flanges. The front flange is bolted to the rear of the combustion chamber outer case (Flange E) and the rear flange is bolted to the turbine exhaust case (Flange F). Eight bosses, radially disposed around the front end of the case, provide mounting for the T4.5 thermocouple probes. A slotted integral land on the inside of the case provides a mount for the second-stage stator assembly.



LP Turbine Module
Figure 2

The fifth-stage stator assembly and turbine outer air seal ring mount on the aft end of the case (Flange F) with slots and lugs. The three turbine outer air seal rings each have a honeycomb air seal ribbon brazed to its inside diameter. The air seals are machined to lock in place with the stator assemblies.

4. Turbine Exhaust Case and No. 4 Bearing Housing (Ref. Fig. 3)

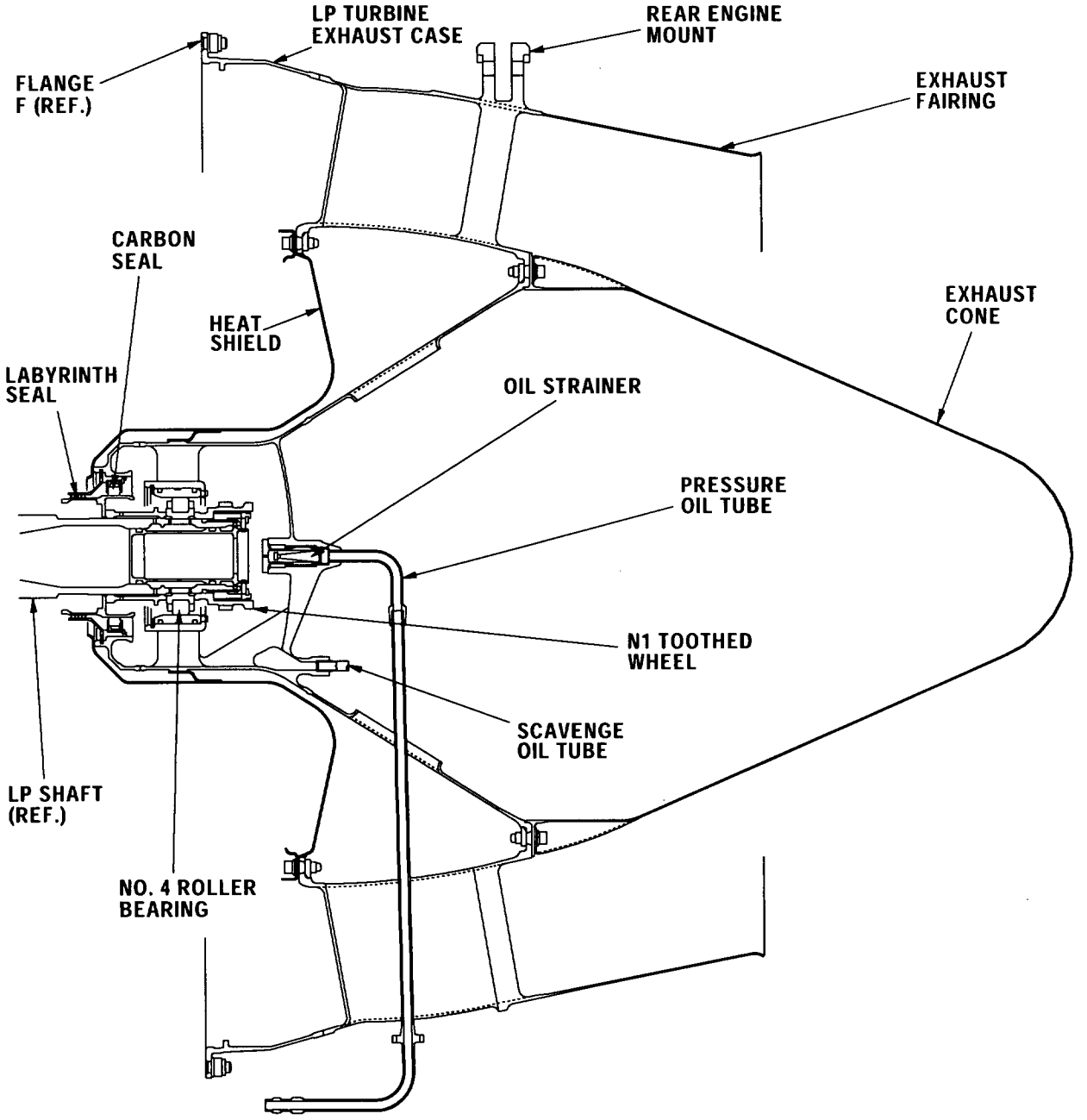
The turbine exhaust case consists basically of an inner and outer exhaust duct, supported by six equally spaced hollow struts. The center section of the case embedded the No. 4 bearing compartment.

The strut at the 4 o'clock position provides passage for the No. 4 bearing pressure oil line and two N1 speed probe cables. The strut at the 6 o'clock position provides passage for the emergency fuel shutoff cable, while the strut at the 8 o'clock position houses the No. 4 bearing scavenge oil line.

A flange at the front end of the outer bypass duct bolts to the rear flange of the LP turbine case (Flange F), while a flange on the rear of the duct supports the exhaust fairing. Two integral engine mounts are located at 45 degrees above and below the horizontal centerline on either side of the case and a boss at the 6 o'clock position serves as a fuel drain.

The inner bypass duct supports a heatshield at its front flange, which provides thermal protection to the No. 4 bearing compartment. A flange on the rear of the inner duct provides a mount for the exhaust cone.

The centerbore supports the No. 4 roller bearing which is sealed at the front by a labyrinth air seal and a carbon seal. The rear of the compartment is sealed by an integral cover which houses an oil jet strainer for pressure oil, a scavenge oil outlet, two N1 speed probes and the mechanical fuel shutoff trigger mechanism.



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Turbine Exhaust Case
Figure 3

HP TURBINE - REMOVAL/INSTALLATION

1. General

A. The following section describes the removal and installation of the HP turbines. The procedures described in this section can only be done during Heavy Maintenance.

B. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

C. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

The consumable materials listed below are used in the following procedures.

Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC04-003	Grease, Synthetic
PWC05-068	Tape, Masking
PWC05-078	Oil, Releasing
PWC05-102	Ice, Dry
PWC06-009	Compound, Anti-seize
PWC06-015	Beeswax
PWC09-002	Compound, Locking and Retaining
PWC11-014B	Isopropyl Alcohol
PWC11-027	Solvent, Petroleum

3. Special Tools

The special tools listed below are used in the following procedures.

Tool No.	Name	Application
PWC30304-23	Rivet Set	
PWC30304-35	Rivet Set	
PWC32505	DELETED	Replaced by PWC71392
PWC32506	DELETED	Replaced by PWC89837
PWC32550	Adapter	Obsolete, replaced by PWC41150
PWC37807	Pump	
PWC40323	Puller	Replaces PWC43205
PWC41050	Wrench	
PWC41150	Adapter	Alternate to PWC32550
PWC43053	Fixture	
PWC43057	Pad	

Tool No.	Name	Application
PWC43063	Fixture	
PWC43064	Adapter	
PWC43071	Puller	Pre-SB24103
PWC43072	Drift	
PWC43205	DELETED	Replaced by PWC40323
PWC43206	Drift	
PWC43209	Puller	
PWC43213	Puller	
PWC43215	Base	
PWC43250	Protector	
PWC43275	Socket	Post-SB24197
PWC43276	Adapter	Post-SB24197
PWC43277	Puller	
PWC43279	Puller	
PWC43280	Pusher	
PWC43281	Puller	
PWC43284	Support	
PWC43286	Drift	
PWC43357	Puller	
PWC43515-11	Bar	
PWC43661	Riveter	
PWC60014	Pusher	
PWC60079	Puller	
PWC60101	Adapter	
PWC60102	Gage	
PWC60102-10	Nut	
PWC60105	Wrench	
PWC60136	Heater Controller	
PWC60122	Grinding Fixture	
PWC60139	Puller	Post-SB24103
PWC60177	Puller	
PWC60234	Socket	Post-SB24197
PWC60242	Crimper	Post-SB24197
PWC60331	Adapter	
PWC60387	Riveter	
PWC60398	Spacer	
PWC60531	Pad	
PWC60543	Punch	Post-SB24197
PWC60623	Fixture	
PWC60719	Support	
PWC60731	Fixture	

Tool No.	Name	Application
PWC60738	Fixture	
PWC60791	Gage	
PWC60916	Heater Assembly	
PWC60930	Adapter	
PWC61014	Stub Shaft Guide	
PWC61823	Pad	
PWC71392	Adapter	Replaces PWC32505
PWC89837	Cylinder	Replaces PWC32506

4. Fixtures, Equipment and Supplier Tools

Not Applicable

5. Second-stage HP Turbine Disk

A. Removal of HP Turbine Nut (Ref. Fig. 401 and 402)

(1) Remove protector (PWC43250) from shaft.

(2) Measure second-stage HP turbine tip clearance at four locations equally spaced around shroud housing and record as Dim. B.

NOTE: This measurement will be used during the calculation of second-stage shroud segments.

(3) Remove retaining ring (1) and keywasher (2), (Pre-SB24197) or unstake cupwasher (10), (Post-SB24197) using punch (PWC60543).

(4) Soak the threads on the HP turbine retaining nut and compressor rotor stub shaft with release oil (PWC05-078). Rotate turbine several times, to allow oil to penetrate thread. Allow oil to soak for 30 minutes before loosening nut.

(5) Heat retaining nut with a suitable heat gun for a minimum of 30 minutes.

(6) Do steps (a) thru (f) as quickly as possible after heating:

(a) Soak the threads on the HP turbine retaining nut and compressor rotor stub shaft with release oil (PWC05-078).

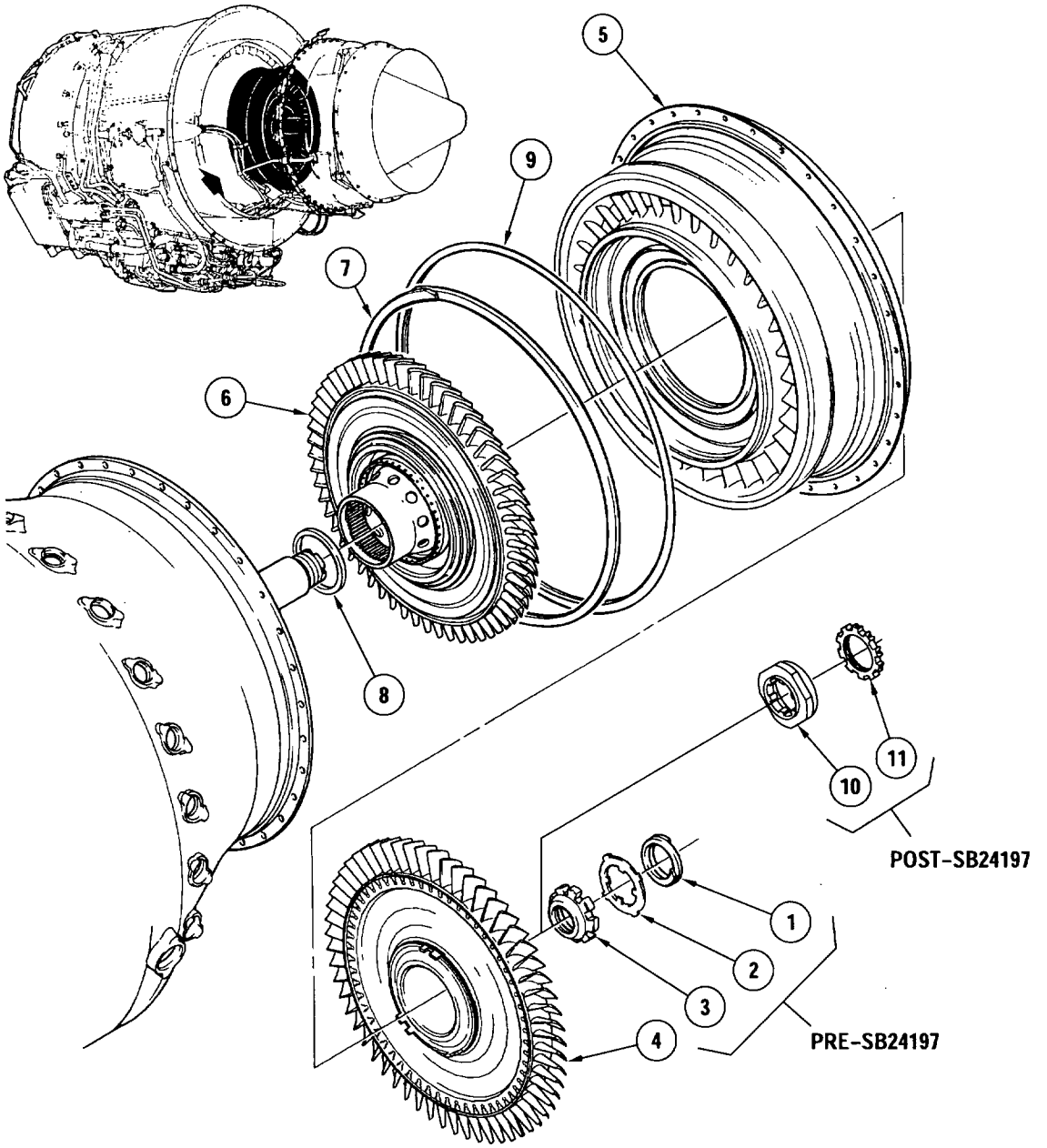
(b) Pre-SB24197:

1 Install adapter (PWC43276) on HP turbine shaft.

2 Install socket (PWC43275) over adapter and engage anti-rotation features.

3 Install support (PWC60719) on Flange E and secure with three bolts (thread size 0.250-20 UNJF).

(c) Post-SB24197:



C19653D

Removal of HP Turbine and Related Parts
Figure 401

Key to Figure 401

1. Retaining Ring
2. Keywasher
3. HP Turbine Retaining Nut
4. Second-stage HP Turbine Disk Assembly
5. HP Turbine Shroud Housing Assembly
6. First-stage HP Turbine Disk Assembly
7. Seal Ring
8. Spacer
9. Gasket

1 Install adapter (PWC60331) on HP turbine shaft.

2 Install socket (PWC60234) over adapter and engage anti-rotation features.

3 Install support (PWC60243) on Flange E and secure with three bolts (thread size 0.250-20 UNJF).

(d) Install adapter (PWC32550) or (PWC41150) on wrench (PWC41050).

(e) Insert drive bar (PWC43515-11).

CAUTION: DO NOT EXCEED 1200 lb. ft. (1627 Nm) TORQUE WHILE LOOSENING NUT.

(f) Install wrench (PWC41050) on socket and loosen retaining nut.

(7) If the HPT retaining nut will not loosen, proceed as follows, with drilling fixture (PWC60731):

(a) Install body (1, Fig. 402) on HPT shaft and engage locater (2) into any slot in nut. Lock locater with screw.

(b) Install nut (3) on the end of the LP shaft and tighten handtight against body (1).

(c) Loosen stopper (7) on drill bit (6).

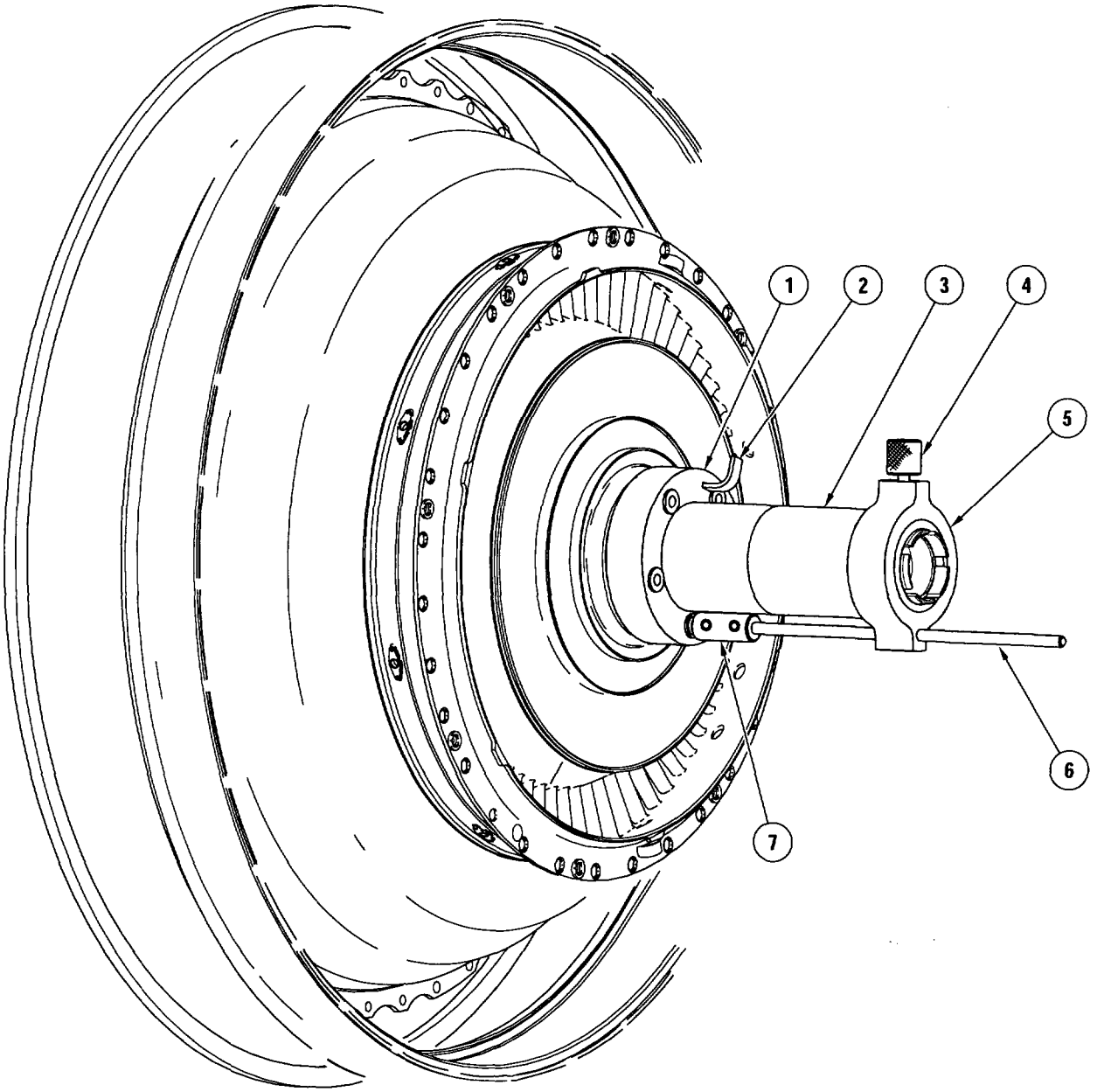
(d) Install setting gauge on drill bit, in front of stopper (7).

CAUTION: DO NOT USE HOLE IN LINE WITH EITHER OF TWO DIMPLES IN HPT NUT.

(e) Put drill bit (6) into one of five bushed holes. Slide bit forward until point of drill contacts HPT nut.

(f) Slide stopper (7) against surface of setting gauge and tighten screws in stopper (7).

(g) Remove drill bit and setting gauge.



C71140

Installation of Drilling Fixture
Figure 402

Key to Figure 402

1. Body
2. Locater
3. Nut
4. Screw
5. Collar
6. Drill Bit
7. Stopper

(h) Remove setting gauge from drill.

(i) Install collar (5) on nut (3) and drill bit (6). Tighten collar screw (4) against nut (3).

(j) Install drill bit into suitable power drill.

(k) Drill a minimum of 5 to a maximum of 10 holes by relocating body (1), collar (5) and drill bit (6).

NOTE: Lubricant is not required.

(8) Remove tools and retaining nut.

B. Removal of HP Turbine Disk

(1) Install pad (PWC61823) against end of compressor rotor stubshaft.

(2) Install split-body of puller (PWC43277) over lip of second-stage turbine disk.

(3) Install sleeve of puller (PWC43277) over split-body.

(4) Install lifting fixture (PWC60623) on Flange E and second-stage turbine disk assembly (4).

(5) Screw cylinder (PWC89837) into adapter (PWC71392).

(6) Install adapter (PWC71392) on end of puller. Make sure lock of adapter aligns with the word "LOCK" on puller.

(7) Install pump (PWC37807) onto cylinder.

(8) Index mark HP turbine housing (5) at top center position, prior to removal, using an approved marker.

CAUTION: DUE TO THE TIGHT FIT BETWEEN THE FIRST AND SECOND-STAGE HP TURBINE DISKS, BOTH DISKS AND THE HP TURBINE HOUSING ASSEMBLY CAN SEPARATE FROM THE ENGINE TOGETHER. IF THIS OCCURS, MAKE SURE THE FIRST-STAGE HP TURBINE DISK DOES NOT FALL FROM ASSEMBLY.

CAUTION: MAKE SURE PAD (PWC61823) DOES NOT FALL FROM COMPRESSOR STUBSHAFT WHEN REMOVING TURBINES.

(9) Remove second-stage HP turbine disk assembly by applying pump pressure.

(10) Carefully put turbine disk assembly or assemblies on bench.

(11) If turbine separation is required refer to next operation.

(12) Remove HP turbine housing (5) and discard gasket (9).

(13) Remove seal ring (7) from first-stage HP turbine vane.

(14) Inspect the rotor air seal to make sure the air seal damper is installed. If the air seal damper is not installed, replace the rotor air seal (Ref.11.).

6. First-stage HP Turbine Disk

A. Removal (Ref. Fig. 401)

(1) If the first-stage HP turbine assembly was not removed with the second-stage HP turbine remove as follows:

(a) Install pad (PWC61823) in compressor stub shaft.

(b) Install puller (PWC43279) on first-stage HP turbine.

(c) Remove first-stage HP turbine and put it on the bench.

(2) Inspect the rotor air seal to make sure the air seal damper is installed. If the air seal damper is not installed, replace the rotor air seal (Ref.11.).

7. Separatation of HP Turbine from Shroud Housing

A. Procedure (Ref. Fig. 403)

(1) Put holding fixture (5) on bench. Push two holding arms (8) in, to center of fixture.

(2) Put HP turbines and housing assembly on holding fixture (5).

(3) Pull two holding arms (8) out, until two clamps (6) seat between first and second-stage HP turbines (9 and 4).

(4) Install spacer (1), pad (2) and puller (3).

(5) Install adapter (PWC71392), hydraulic cylinder (PWC89837) and pump (PWC37807). Apply pressure to separate HP turbines.

(6) Remove second-stage HP turbine disk assembly (4).

(7) Remove HP turbine housing (10).

(8) Push holding arms (8) into the center of holding the fixture, until two clamps (6) disengage from first-stage HP turbine (9).

(9) Remove first-stage HP turbine (9) from holding fixture.

8. Replacement of HP Turbine

A. HP Turbine Trim Balance Weight Replacement (Ref, Fig. 425)

CAUTION: ENGINE BALANCING PROCEDURES REQUIRE THAT THE COMPRESSOR ROTOR BALANCE BE OBTAINED BY MAKING TRIM ADJUSTMENTS TO THE HP TURBINES. THE FOLLOWING SPECIAL ASSEMBLY TECHNIQUES MAY BE NECESSARY FOR FIELD INSTALLATION OF REPLACEMENT TURBINES.

(1) Find the location and class of any necessary trim balance counterweight by referring to the engine trim data plate located on accessory gearbox. Refer to the trim code definition for planes G and D (Ref. Fig. 425). Examine the trim plate and how it relates to the trim weights installed on planes D and G of the HP turbines (Ref. Sht. 2).

CAUTION: IF THE INFORMATION RECORDED ON THE ENGINE TRIM DATA PLATE IS DIFFERENT FROM THE INFORMATION RECORDED IN THE ENGINE LOG BOOK CONTACT P&WC CUSTOMER SUPPORT.

(2) If a reference cannot be found on the trim data plate check the engine log book. If there is no reference in engine log book, then no trim balancing is necessary.

(3) It is necessary to give the location and class of any trim weights installed on correction planes G and D when ordering replacement turbines. Request that the necessary trim weight be installed when ordering the replacement turbines.

NOTE: If this step has not been observed, it is possible that the balanced replacement assembly will have a detail balance weight installed where a trim weight is necessary. If this occurs, the assembly must be rebalanced to allow for installation of trim balance weight.

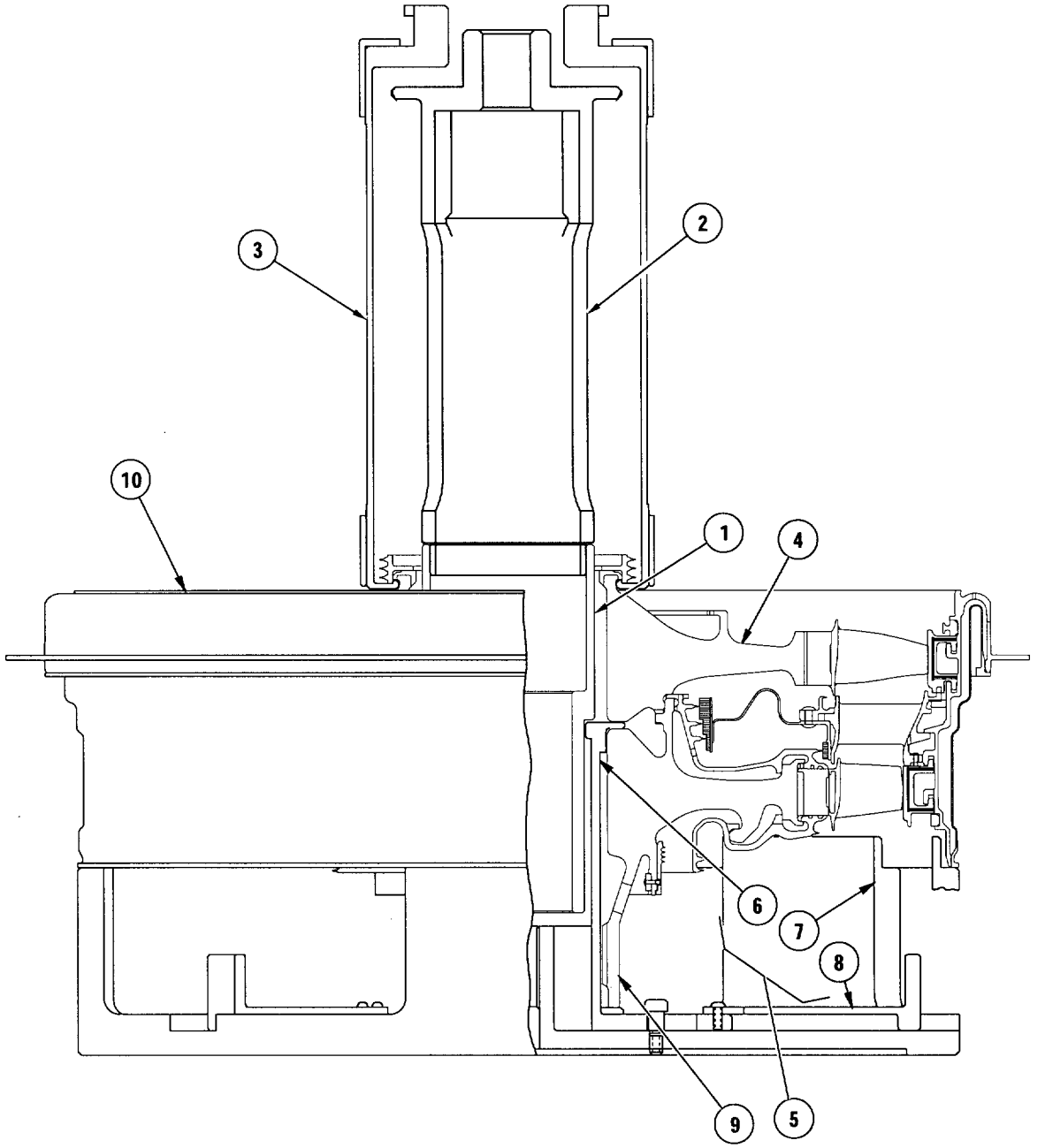
9. HP Turbine Housing and Second-stage Turbine Stator

A. Disassembly (Ref. Fig. 404)

NOTE: The HP turbine housing and second-stage turbine stator should be inspected as an assembly and therefore does not need to be disassembled. However, if damage is noted, disassemble as required.

(1) Place turbine housing (6) on bench with Flange E up.

(2) Remove shroud retaining ring (12).



C31508B

Separation of HP Turbine from Housing Assembly
Figure 403

Key to Figure 403

1. Spacer (PWC60398)
2. Pad(PWC60531)
3. Puller (PWC43277)
4. Second-stage HP Turbine Disk Assembly
5. Holding Fixture (PWC43053)
6. Clamp (part of PWC43053)
7. Base (part of PWC43053)
8. Holding Arm (part of PWC43053)
9. First-stage HP Turbine Disk Assembly
10. HP Turbine Housing Assembly

(3) Remove 18 shroud segments (11) from turbine housing (6) by moving segments up, to disengage locking feature, using puller (PWC60079).

(4) Pull one segment into center of turbine housing.

(5) Separate 18 shroud segments (11), remove and retain 36 seals (10) and 18 seals (9).

(6) Turn turbine housing (6) on bench so that Flange E is down.

(7) Remove shroud retaining ring (1).

(8) Remove 18 shroud segments (4) from turbine housing (6) by moving all segments up, to disengage locking feature, using puller (PWC60079).

(9) Pull one segment into center of turbine housing.

(10) Separate 18 shroud segments (4). Remove and retain 36 seals (3) and 18 seals (2).

(11) Put an X mark on the alignment lug of the turbine stator assembly (7) in line with the offset hole (Top Center) on Flange E of turbine housing (6), using an approved marker (Ref. View A).

(12) Pull turbine stator assembly (7) up to disengage locking feature, then rotate stator clockwise 5 degrees and lower it from housing.

(13) Remove seal ring (8).

(14) If required remove baffle (5) using puller (PWC43071) (Pre-SB24103) or (PWC60139) for all other baffles.

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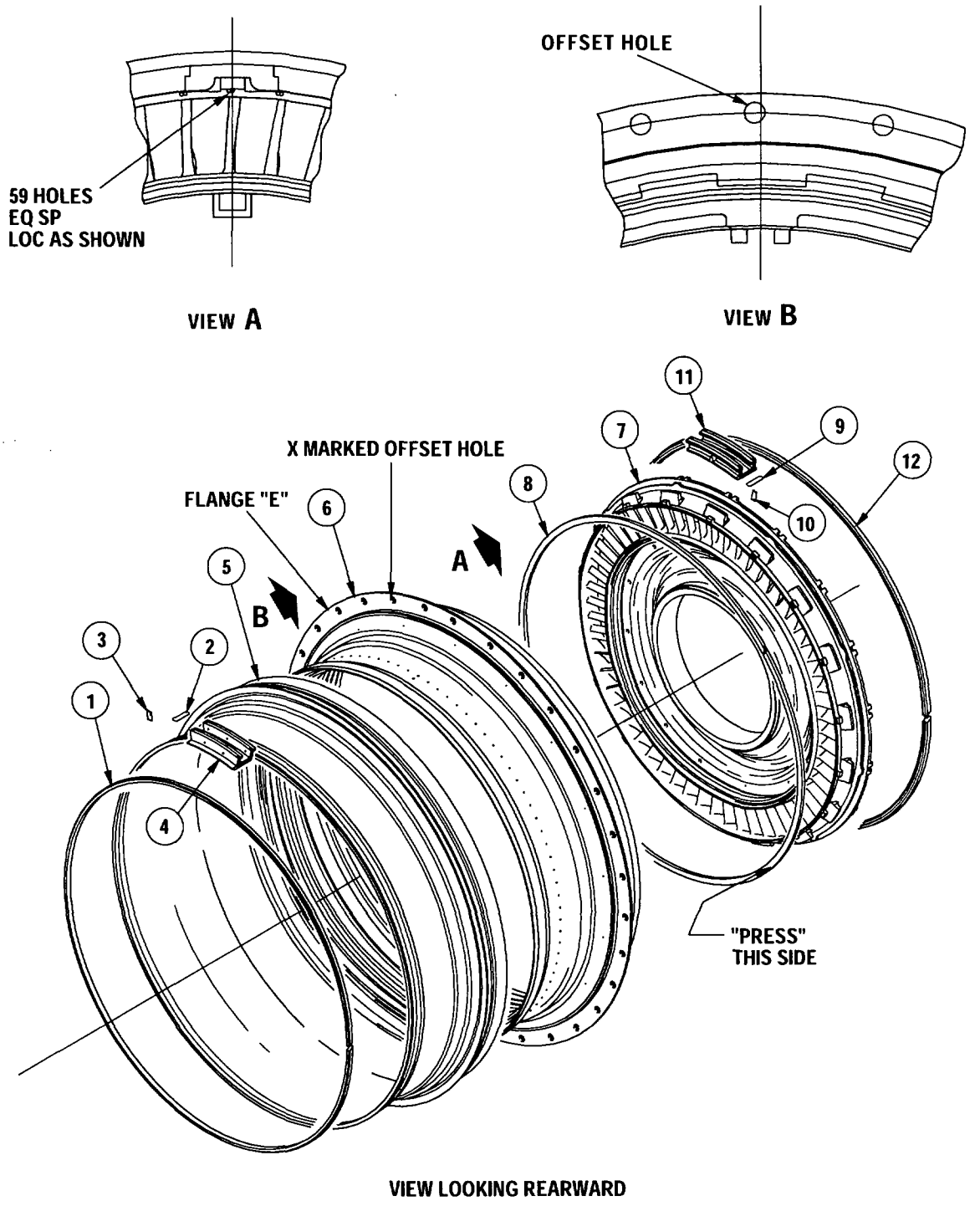


C31279

Disassembly of HP Turbine Housing and Second-stage Turbine Stators
Figure 404

Key to Figure 404

1. Shroud Retaining Ring
2. Seal
3. Seal
4. Shroud Segment (First-stage)
5. HP Turbine Baffle Assembly
6. HP Turbine Housing Assembly
7. Turbine Stator Assembly
8. Seal Ring
9. Seal
10. Seal
11. Shroud Segment (Second-stage)
12. Shroud Retaining Ring

10. First-stage HP Turbine Vane Assembly

A. Removal of First-stage HP Turbine Vane Assembly (Ref. Fig. 405 and 406)

NOTE: The first-stage HP turbine vane can be removed at this time to allow access to the combustion chamber liner assembly for inspection purposes. The vane can also be removed with the combustion chamber case assembly (Ref. 72-40-01).

(1) Put an index mark, at top center position, through the two bolting flanges of the first-stage HP turbine vane using an approved marker.

CAUTION: DO NOT PUSH ON BOLTS.

(2) Remove and retain 15 bolts (3).

(3) Pre-SB24174:

(a) Remove turbine stator seal assembly (2, Fig. 406) using puller (PWC43281).

NOTE: The Post-SB24174 stator seal is removed with the vane assembly.

CAUTION: MAKE SURE NUTS (2) DO NOT DROP INSIDE THE COMBUSTOR.

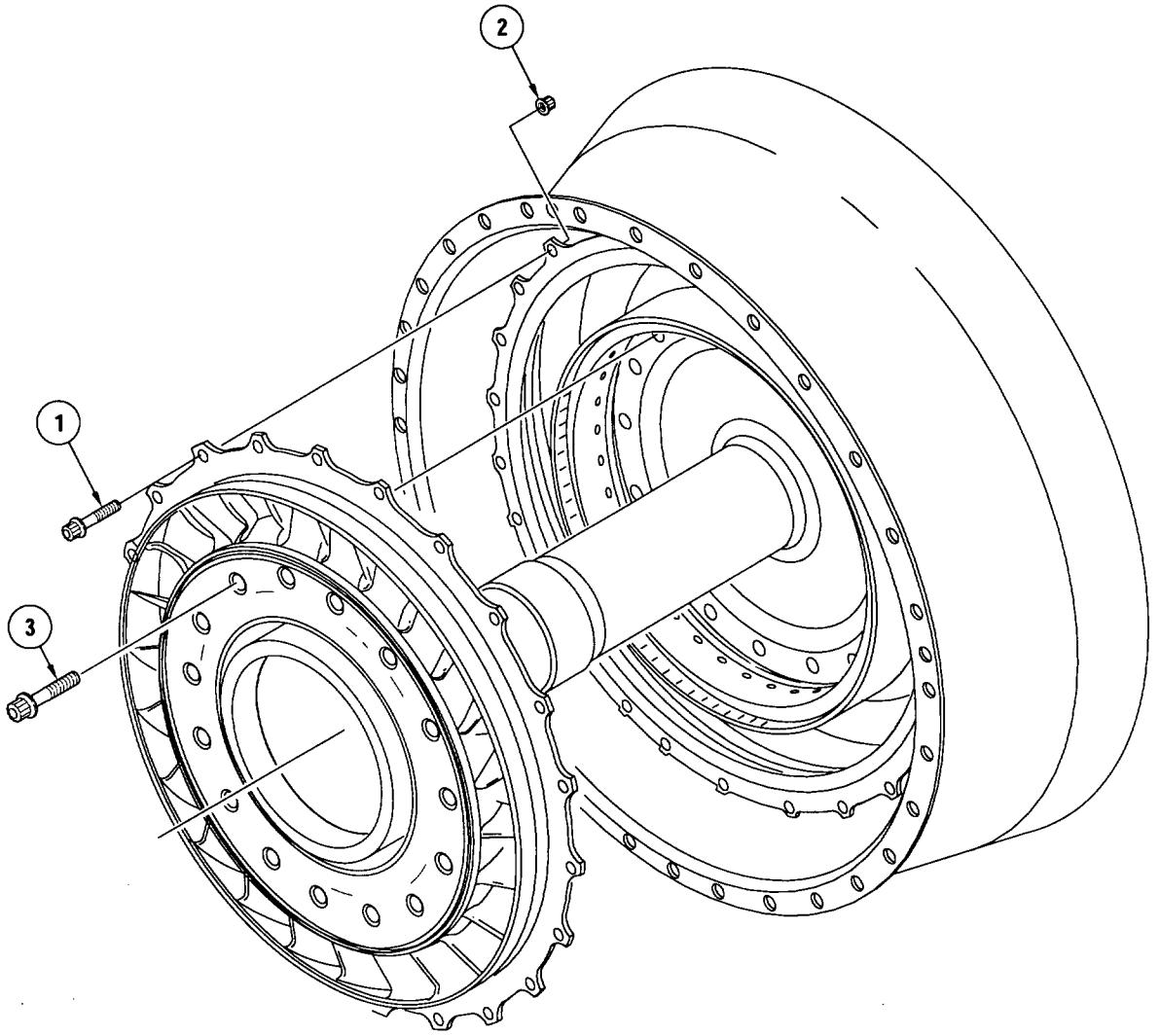
(4) Remove 24 bolts (1, Fig. 405) and nuts (2) using wrench (PWC60105) to hold nuts at forward flange of the vane.

(5) Loosely install three bolts (3) through vane assembly.

(6) Remove first-stage HP turbine vane assembly as follows:

(a) Unseat vane assembly from gas generator case by gently tapping on the front face of the turbine disk air nozzle (4, Fig. 406) using puller (PWC43209).

(b) Remove three bolts (3, Fig. 405).



C34456

Removal of First-stage HP Turbine Vane Assembly
Figure 405

(c) Install three nuts (2) and bolts (1, Fig. 406) to secure vane assembly.

(d) Remove vane assembly.

(e) Install three slave bolts (5) and nuts (3).

B. Disassembly of First-stage HP Turbine Vane Assembly (Pre-SB24174) (Ref. Fig. 406)

(1) Number all vane segments for correct location using an approved marker.

(2) Remove slave nuts (11) and bolts (9). Separate and remove first-stage HP turbine vane shroud (12) and turbine vane retaining plate (10).

(3) Remove slave nuts (3), bolts (5) and turbine stator seal assembly (2).

(4) Separate and remove 32 first-stage HP turbine vane assemblies (1) from first-stage HP turbine vane shroud (6).

(5) Remove and discard inner and outer turbine vane air seals (7 and 8).

(6) Remove turbine disk air nozzle (4) using drift (PWC43286).

C. Disassembly ofFirst-stage HP Turbine Vane Assembly (Post-SB24174) (Ref. Fig. 407)

(1) Put first-stage HP turbine vane assembly on the bench as shown.

(2) Remove slave nuts (1) and bolts (4).

(3) Press turbine disk air nozzle assembly (3) out of vane assembly using a suitable drift.

(4) Remove slave nuts (9), bolts (10) and turbine retaining plate (8).

(5) Remove vane shroud (11).

(6) Turn vane assembly over on bench.

(7) Separate vane shroud (7) from turbine stator seal (2).

(8) Remove 10 first-stage HP turbine vane assemblies (6).

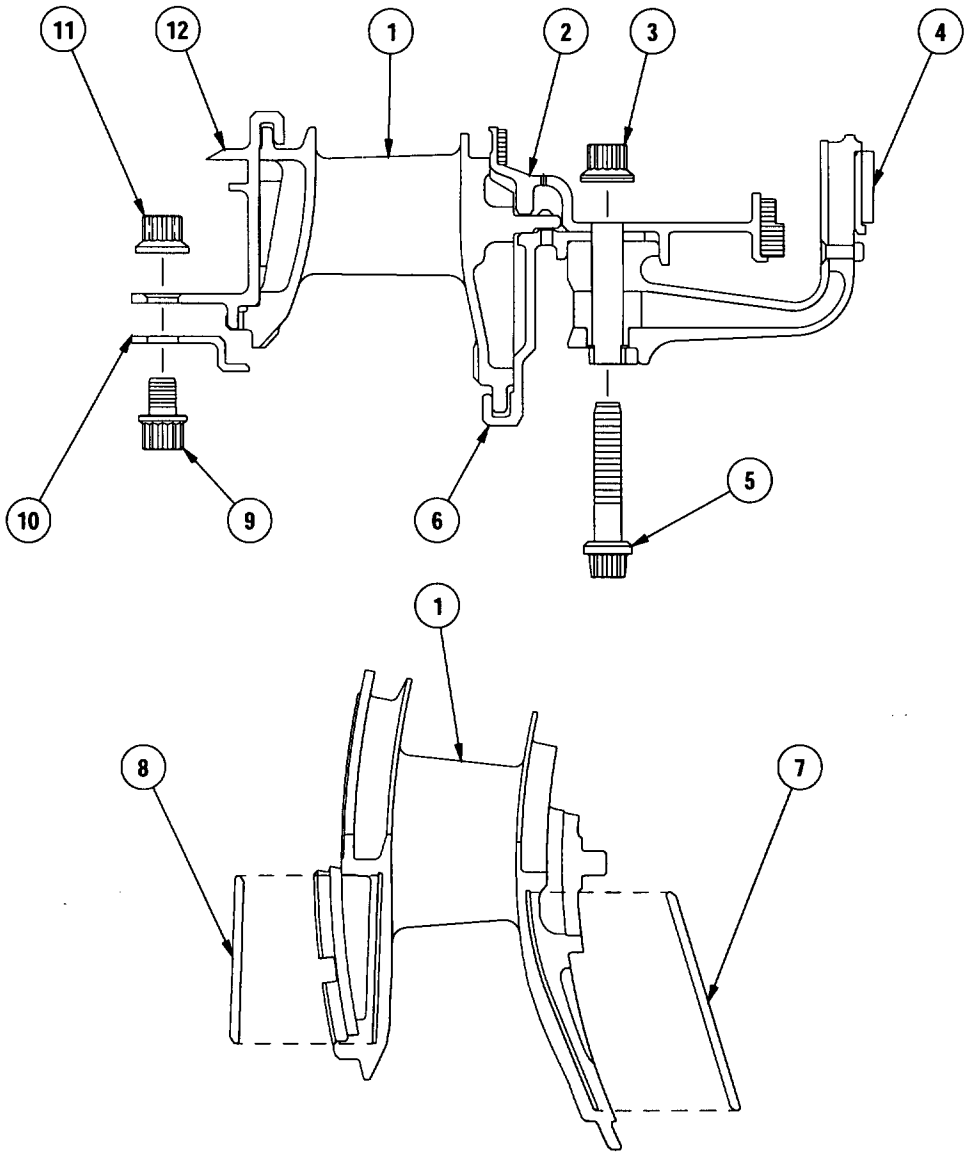
(9) Separate and remove 20 turbine vane air seals.

D. Disassemble First-stage HP Turbine Vane Assembly (Post-SB24490) (Ref. Fig. 408)

(1) Put first stage HP turbine vane assembly on the bench with seal support (8) down.

(2) Number all vane segments (6) starting with vane number 1 at the X-marked offset hole. Continue in a clockwise direction number the segments one thru ten, using approved marker (PWC05-279) or (PWC05-018).

(3) Remove slave nuts (1) and bolts (4).



C31678

Disassembly/Assembly of First-stage HP Turbine Vane (Pre-SB24174)
Figure 406

Key to Figure 406

1. First-stage HP Turbine Vane
2. Turbine Stator Seal Assembly
3. Nut (Slave) 0.190 x 32 UNJF Threads
4. Turbine Disk Air Nozzle Assembly
5. Bolt (Slave) 0.190 x 32 UNJF Threads
6. First-stage HP Turbine Vane Shroud
7. Inner Turbine Vane Air Seal
8. Outer Turbine Vane Air Seal
9. Bolt (Slave)
10. Turbine Retaining Plate
11. Nut (Slave)
12. First-stage HP Turbine Vane Shroud

(4) Press turbine disk air nozzle assembly (3) out of vane assembly using a suitable drift.

(5) Remove bolts (10) and seal support (8).

(6) Remove vane shroud (11).

(7) Turn vane assembly over on bench.

(8) Separate vane shroud (7) from turbine stator seal (2).

(9) Remove 10 first stage HP turbine vane assemblies (6).

(10) Separate and remove 20 turbine vane air seals (5).

E. Assembly of First-stage HP Turbine Vane (Pre-SB24174) (Ref. Fig. 409)

CAUTION: MAKE SURE VANE ASSEMBLIES ARE THE SAME CLASS AS THOSE REMOVED.

(1) Install 32 outer and inner turbine vane air seals (8 and 2) in first-stage HP turbine vane segments (1) (Ref. F&C REF. NO. 1851).

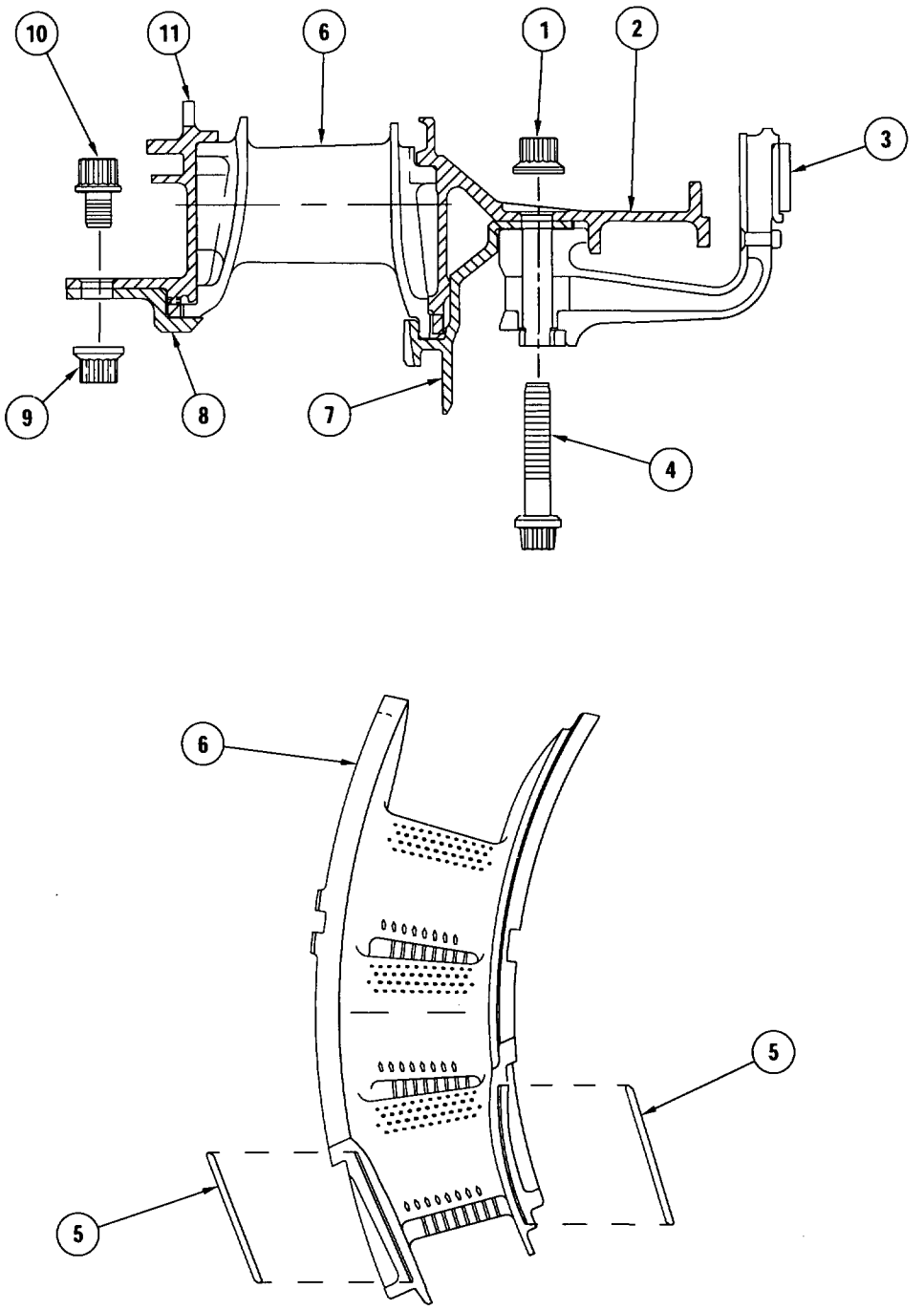
NOTE: Hold air seals in place with synthetic grease (PWC04-003).

(2) Identify the offset holes in items (4, 6, 3 and 9) using an approved marker.

(3) Put first-stage HP turbine vane shroud (4) on bench (Ref. Sht. 2).

(4) Put one first-stage turbine vane segment (1) on first-stage HP turbine vane shroud (4) engaging anti-rotation features. Support outer portion of vane as required.

(5) Position remaining 31 first-stage HP turbine vane segments (1) on first-stage HP turbine vane shroud (4) engaging vanes with seals previously fitted.



C25172

Disassembly of First-stage HP Turbine Vane Assembly (Pre-SB24174)
Figure 407

Key to Figure 407

1. Nut (Slave) 0.190 x 32 UNJF Threads
2. Turbine Stator Seal (60 IPC Fig. 1)
3. Turbine Disk Air Nozzle Assembly (110 IPC Fig. 1)
4. Bolt (Slave) 0.190 x 32 UNJF Threads
5. Turbine Vane Air Seal (75 IPC Fig. 1)
6. First-stage HP Turbine Vane Post-SB24174 (90 IPC Fig. 1)
7. First-stage HP Turbine Vane Shroud (50 IPC Fig. 1)
8. Turbine Retaining Plate (30 IPC Fig. 1)
9. Nut (Slave) 0.190 x 32 UNJF Threads
10. Bolt (Slave) 0.190 x 32 UNJF Threads (IPC Fig.)
11. First-stage HP Turbine Vane Shroud (40 IPC Fig. 1)

(6) Install turbine stator seal (9) aligning offset holes in vane shroud (4) and turbine stator seal (9). Secure using three equally spaced (slave) nuts and bolts (7 and 5). Torque 36 to 40 lb.in. (5.5-6.0 Nm).

(7) Install first-stage HP turbine vane shroud (3) on vane ring assembly aligning offset hole with offset hole in turbine stator seal assembly (9). Make sure alignment lugs engage.

(8) Turn vane ring assembly over so that vane shroud (3) is down.

(9) Align offset holes and attach turbine retaining plate (6) to vane shroud (3) using three equally spaced slave nuts (7) and bolts (5) (0.190 x 32 UNJF). Torque 36 to 40 lb.in. (5.5-6.0 Nm).

(10) Turn vane ring assembly over on bench, with turbine retaining plate (6) down (Ref. Fig. 409 Sht. 2).

(11) Measure gaps between HP turbine vane segments at 32 places (Fits and Clearances REF. NO. 1808).

(12) Adjust gaps between segments by tapping lug at inside diameter of vane in direction required, using a soft-faced drift.

F. Assembly of First-stage HP Turbine Vane (Post-SB24174) (Ref. Fig. 410)

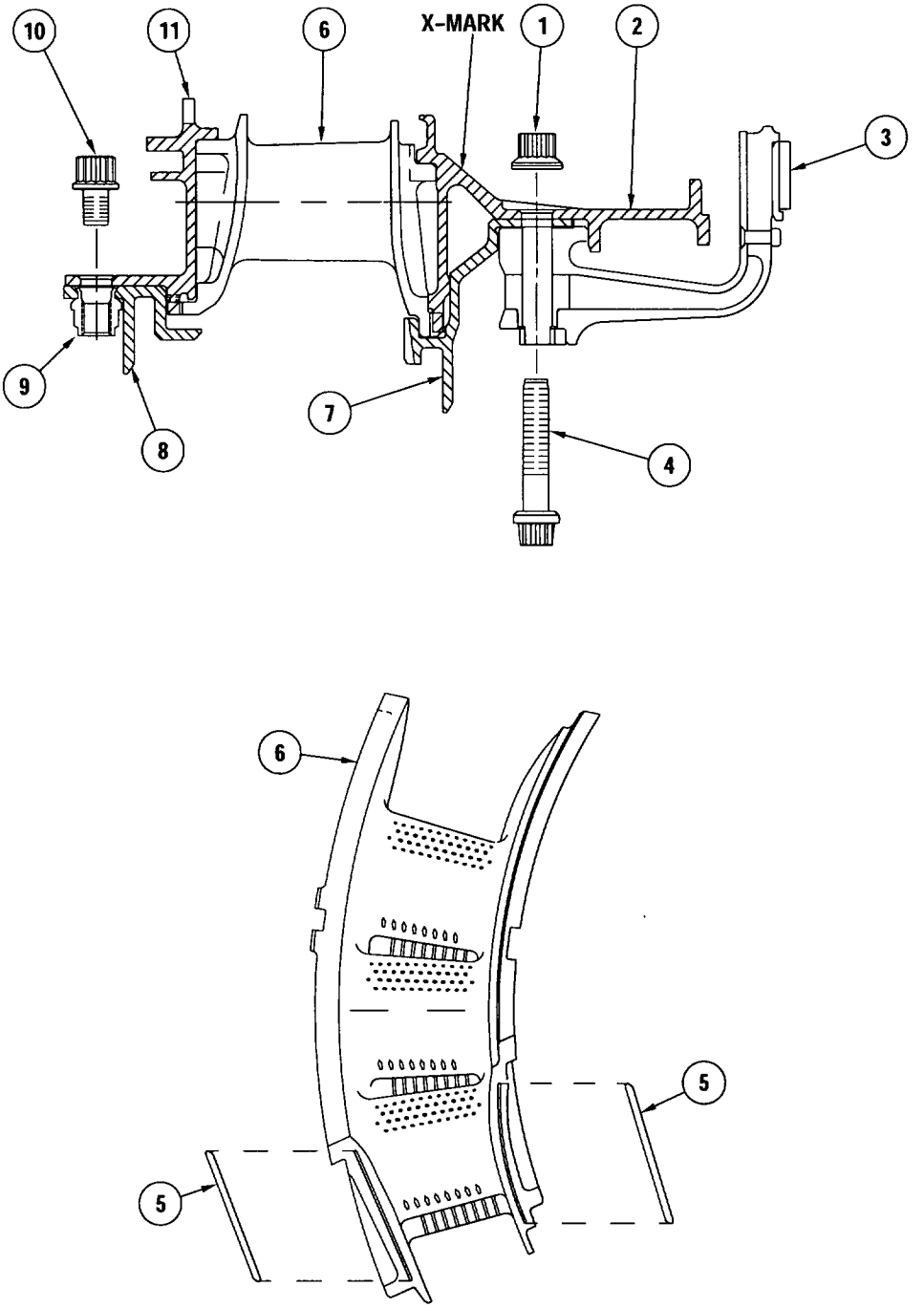
(1) Identify the offset hole in items (2, 3, 4 and 5) using an approved marker.

CAUTION: MAKE SURE VANE ASSEMBLIES ARE THE SAME CLASS AS THOSE REMOVED.

(2) Install 20 turbine vane air seals (8) in 10 first-stage HP turbine vane segments (1) (Ref. F&C REF. NO. 1851).

NOTE: Hold air seals in place with synthetic grease (PWC04-003).

(3) Put turbine stator seal (2) on bench rear face down.



C84540

Disassembly of First-stage HP Turbine Vane Assembly (Post-SB24490)
Figure 408

Key to Figure 408

1. Nut (Slave)
2. Turbine Stator Seal
3. Turbine Disk Air Nozzle Assembly
4. Bolt (Slave)
5. Turbine Vane Air Seal
6. First-stage HP Turbine Vane
7. First-stage HP Turbine Vane Shroud
8. Combustion Liner Rear Seal Support Assembly
9. Shank Nut (Part of item 8)
10. Bolt
11. First-stage HP Turbine Vane Shroud

(4) Install one HP turbine vane segment (1) on stator seal (2), leading edge up. Engage anti-rotation features.

CAUTION: DO NOT FORCE VANE SEGMENTS TOGETHER. DAMAGE TO AIR SEAL COULD RESULT.

(5) Install remaining nine vane segments (1) on stator seal (2) in a counter clockwise direction, engaging seals and anti-rotation features.

(6) Install vane shroud (3) aligning offset holes. Secure using three slave nuts (7) and bolts (6).

(7) Carefully lift the vane assembly and install on vane shroud (4) aligning offset holes.

(8) Install retaining plate (5). Secure using three slave nuts (7) and bolts (6).

(9) Turn assembly over on bench so that retaining plate (5) is down.

(10) Measure gaps between HP turbine vane segments (1) at 10 places, (Ref. Section A-A). Gaps must be within tolerance (Fits and Clearances REF. NO. 1808).

(11) Adjust gaps between segments by tapping lug on inside diameter of vane, in direction required, using a soft-faced drift.

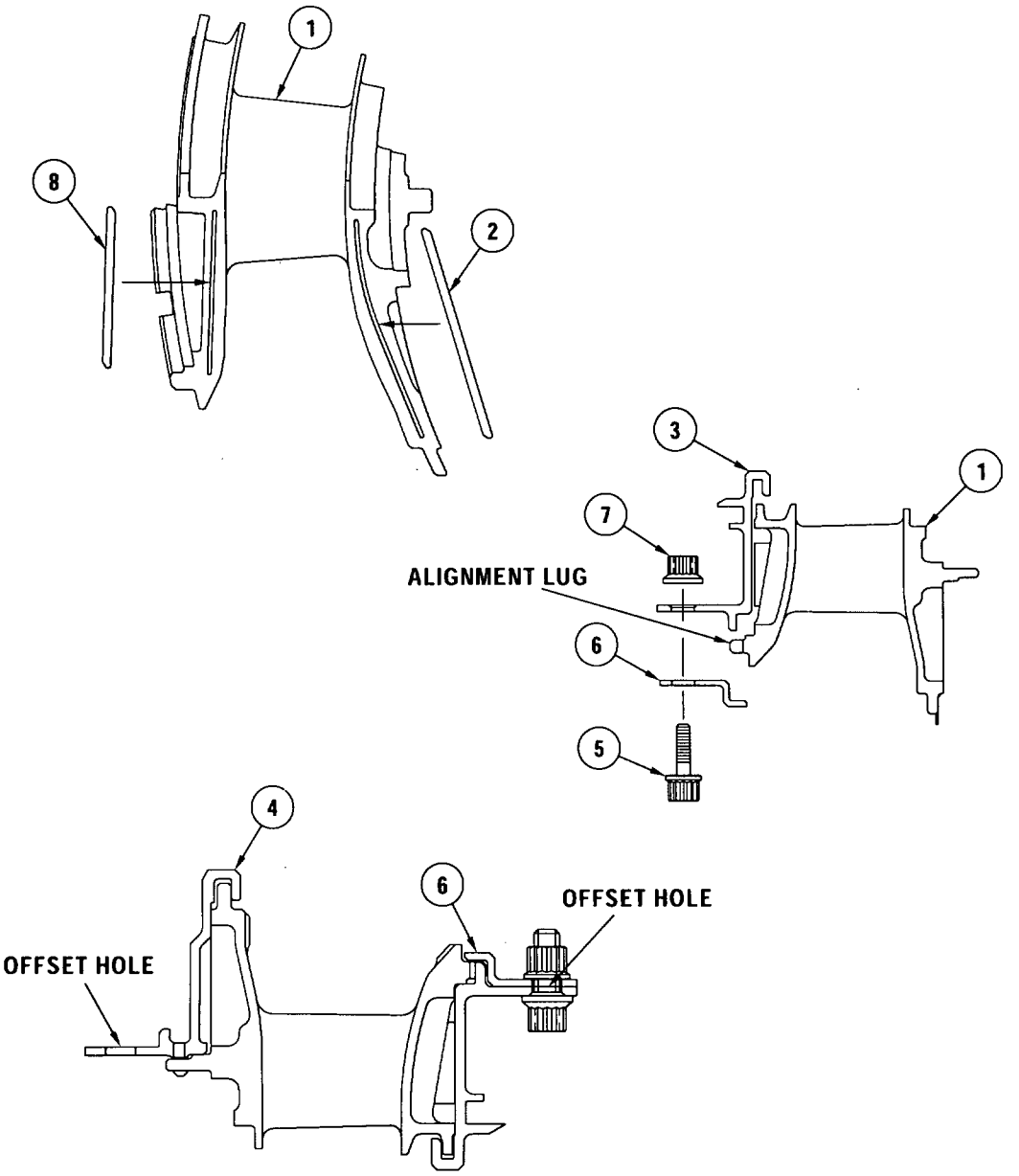
G. Assemble First-stage HP Turbine Vane (Post-SB24490) (Ref. Fig. 411)

(1) Find and mark the offset hole in items (3, 4, 7 and 8) with an X-mark using an approved marker (PWC05-279) or (PWC05-018).

CAUTION: MAKE SURE VANE ASSEMBLIES ARE THE SAME CLASS AS THOSE REMOVED.

(2) Find if new or used serviceable vanes are being installed and continue as follows:

(a) If used vanes are being installed and the location numbers are visable go to step (6) (Ref. F&C REF. NO. 1851).



C31509B

Assembly of First-stage HP Turbine Vane Assembly (Pre-SB24174)
Figure 409 (Sheet 1 of 2)

Key to Figure 409

1. First-stage HP Turbine Vane
2. Inner Turbine Vane Air Seal
3. First-stage HP Turbine Vane Shroud
4. First-stage HP Turbine Vane Shroud
5. Bolt (Slave) 0.190 x 32 UNJF Threads
6. Turbine Retaining Plate
7. Nut (Slave) 0.190 x 32 UNJF Threads
8. Outer Turbine Vane Air Seal
9. Turbine Stator Seal Assembly

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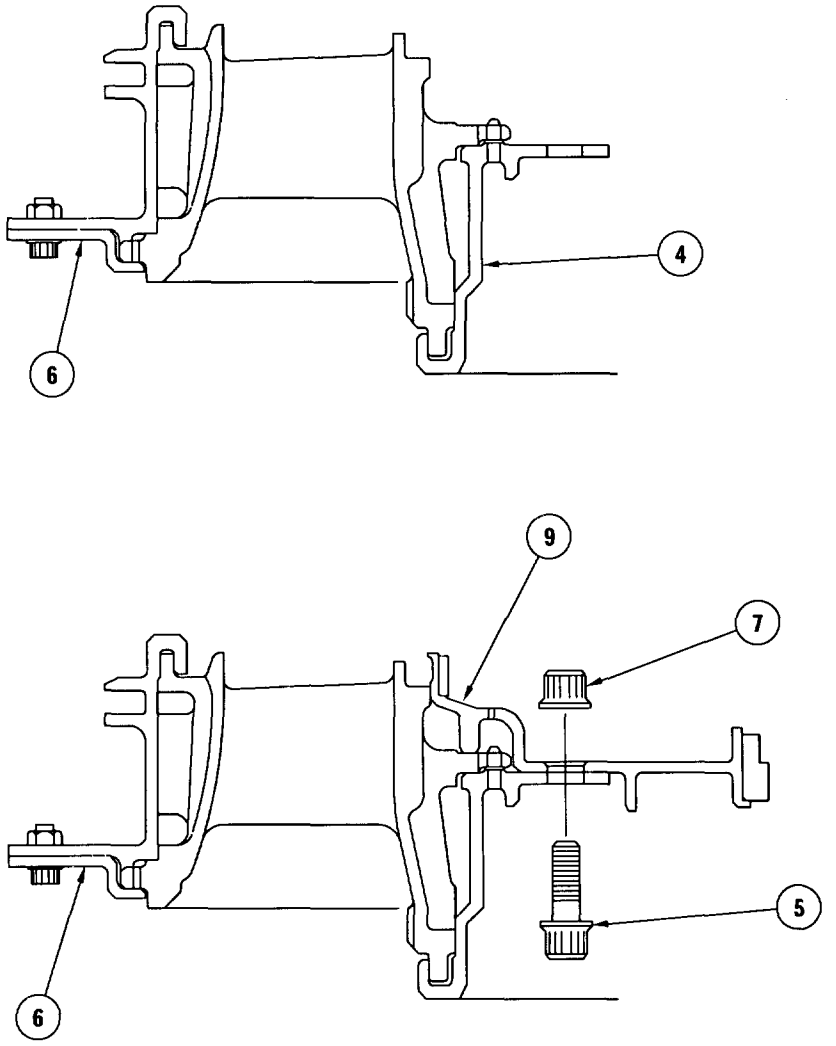
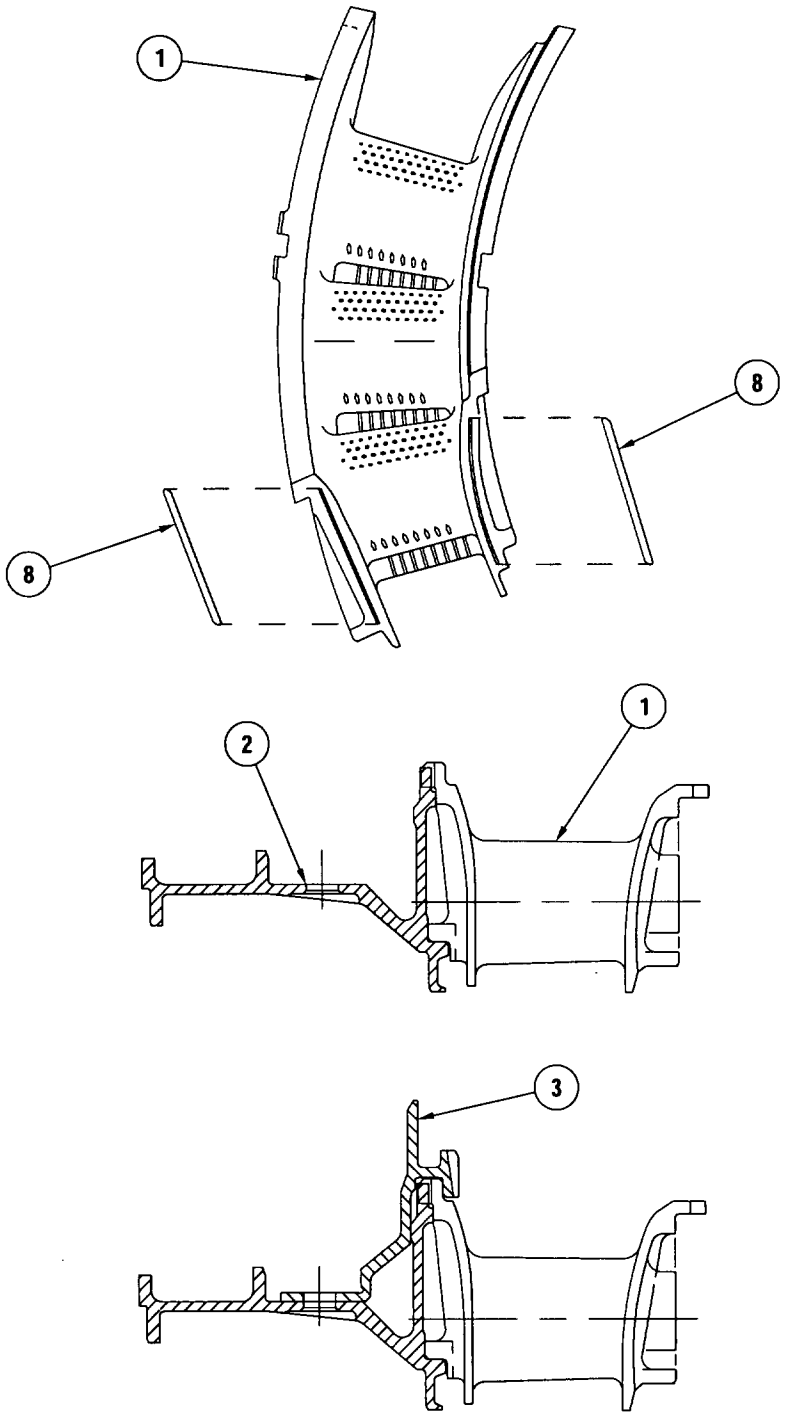


C31510A

Assembly of First-stage HP Turbine Vane Assembly (Pre-SB24174)
Figure 409 (Sheet 2)

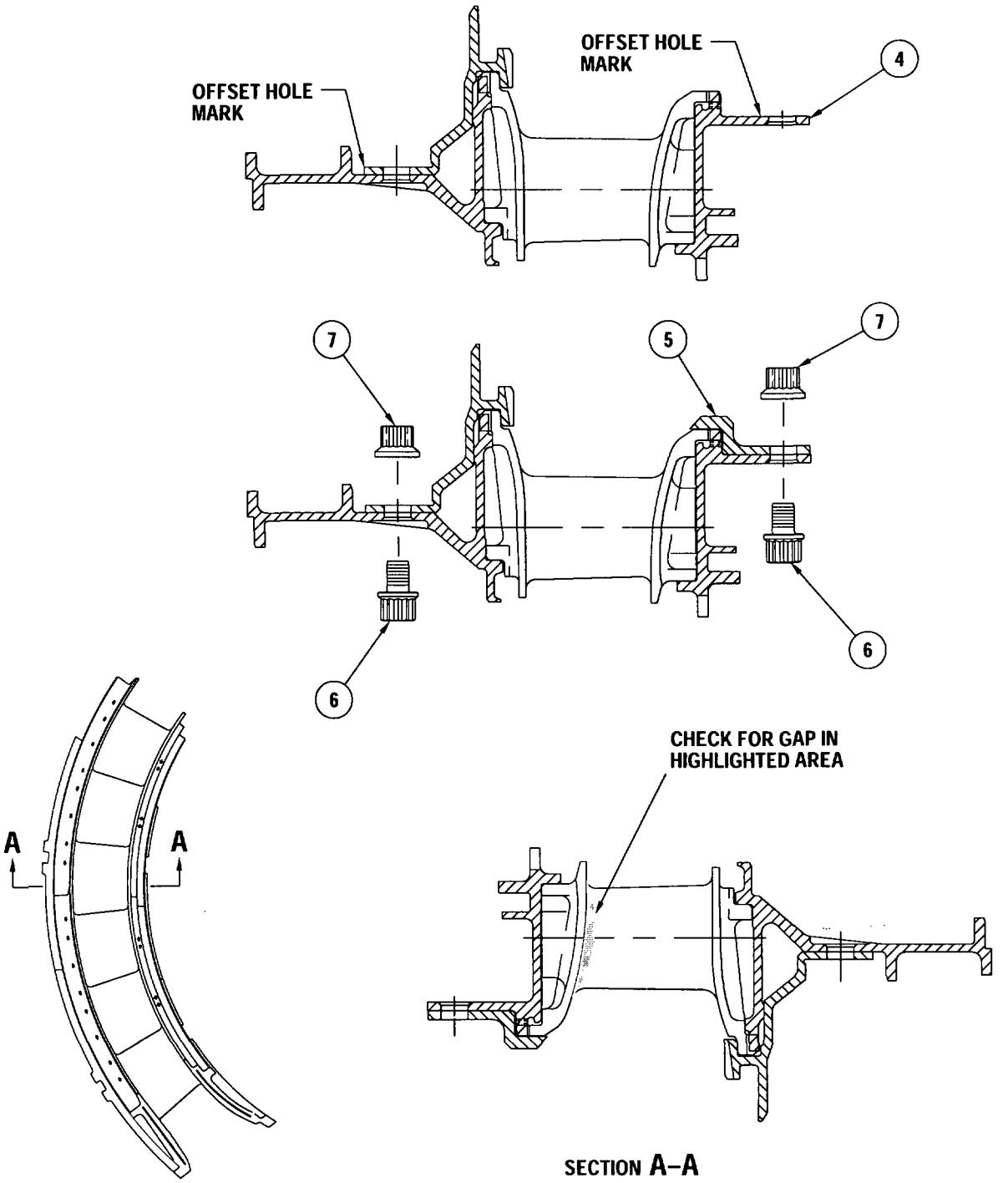


C34458

Assembly of First-stage HP Turbine Vane (Post-SB24174)
Figure 410 (Sheet 1 of 2)

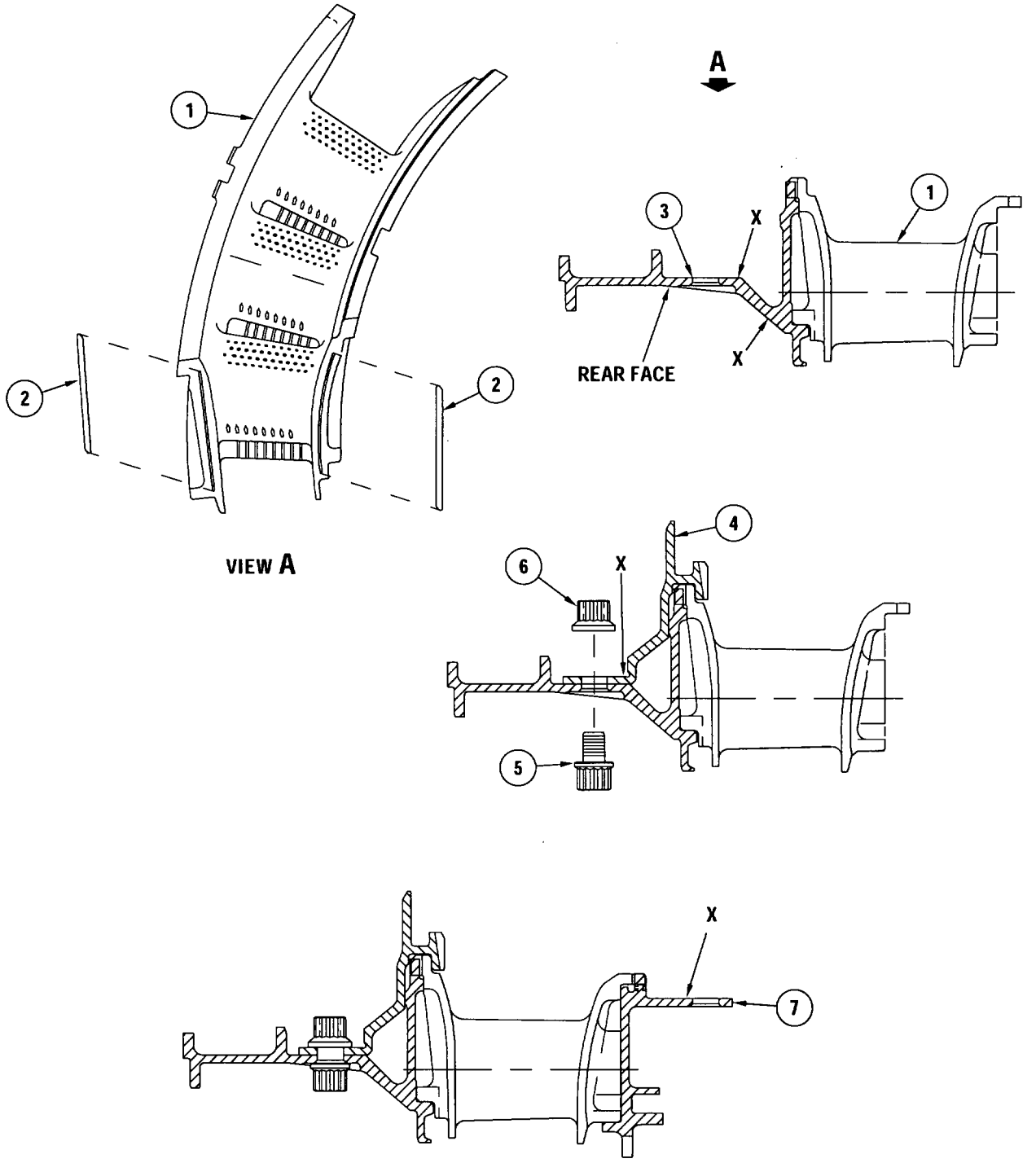
Key to Figure 410

1. First-stage HP Turbine Vane Segments
2. Turbine Stator Seal
3. First-stage HP Turbine Vane Shroud
4. First-stage HP Turbine Vane Shroud
5. Turbine Retaining Plate
6. Bolt (Slave) 0.190 x 32 UNJF Threads
7. Nut (Slave) 0.190 x 32 UNJF Threads
8. Turbine Vane Air Seal



C34459

Assembly of First-stage HP Turbine Vane (Post-SB24174)
Figure 410 (Sheet 2)

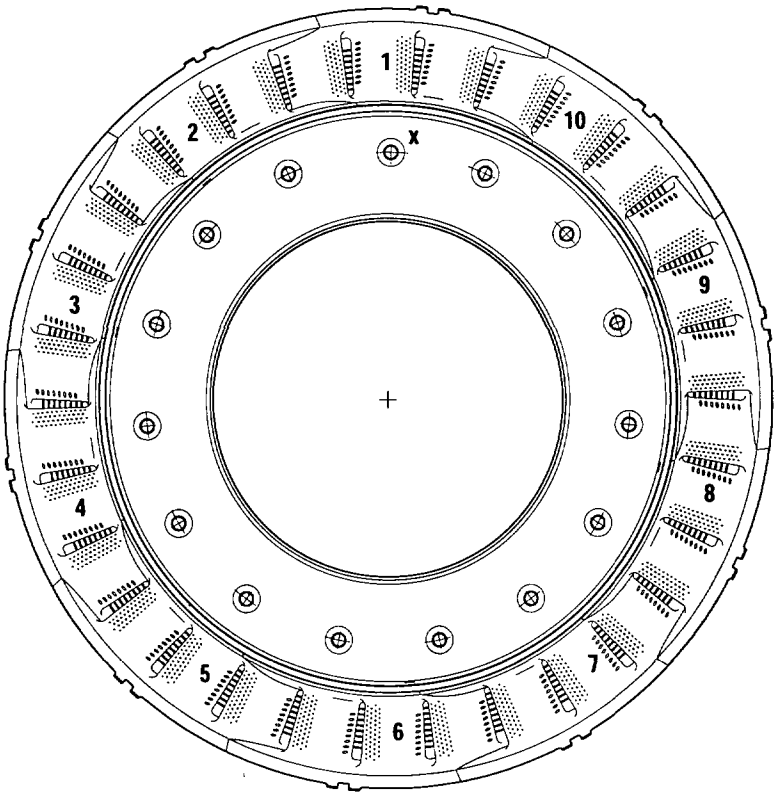


Assembly of First-stage HP Turbine Vane (Post-SB24490)
Figure 411 (Sheet 1 of 2)

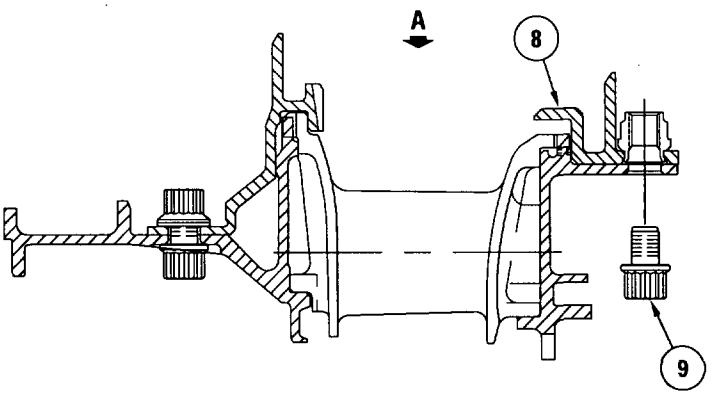
Key to Figure 411

1. First-stage HP Turbine Vane Segments
2. Turbine Vane Air Seal
3. Turbine Stator Seal
4. Rear Combustion Chamber Liner Seal Support
5. Bolt (Slave) 0.190 x 32 UNJF Threads
6. Nut (Slave) 0.190 x 32 UNJF Threads
7. First-stage HP Turbine Vane Shroud
8. Combustion Liner Rear Seal Support Assembly
9. Bolt

P&WC Proprietary Information. Subject to the restrictions on the title page.



VIEW A



C84581

Assembly of First-stage HP Turbine Vane (Post-SB24490)
Figure 411 (Sheet 2)

(b) If new vanes are being installed or the location numbers are not visible go to step (3) (Ref. F&C REF. NO. 1851).

(3) Put ten vanes (1) on the bench with leading edges up. Put the vanes in sequence from lowest to highest class.

(4) Starting with the lowest class vane as number one and finishing with the highest class vane as number ten mark a sequence number on each vane using an approved marker (PWC05-279) or (PWC05-018).

(5) Record the vane class and position number of all ten vanes.

CAUTION: MAKE SURE SEALS FOLLOW THE CONTOUR OF THE VANE.

(6) Install two turbine vane air seals (2) in each of 10 vane segments (1). Hold air seals in place with grease (PWC04-003).

(7) Put turbine stator seal (3) on bench with rear face down.

(8) Install HP turbine vane segment numbered "1" on stator seal (3) with leading edge up at the X-marked offset hole position (Ref. View A Sht. 2). Engage anti-rotation features.

CAUTION: DO NOT FORCE VANE SEGMENTS TOGETHER, DAMAGE TO AIR SEAL COULD RESULT.

(9) Install remaining nine vane segments in sequence numbered "2" to "10" on stator seal (3) in a counterclockwise direction engaging seals and anti-rotation features.

CAUTION: MAKE SURE ALL VANE SLOTS ARE ENGAGED WITH STATOR SEAL LUGS.

(10) Install slave preformed packing AS3209-278 around the outside diameter of the vanes to hold them together.

(11) Install vane shroud (4 Sht. 1) aligning X-marked offset holes. Attach vane shroud (3) using three slave nuts (6) and bolts (5) equally spaced around flange. Torque nuts 36 to 40 lb.in. (4.0-4.5 Nm).

(12) Put vane shroud (7) on bench with front flange up.

(13) Carefully lift the vane assembly and install it in vane shroud (7) aligning the X-marked offset holes. Remove slave packing as necessary.

CAUTION: KEEP BOLTS LOOSE SO THAT SEAL SUPPORT CAN MOVE FREELY.

(14) Install seal support (5 Sht. 2) aligning the X-marked offset holes. Attach using three equally spaced bolts (9).

NOTE: Bolts will be torqued after vane is installed.

(15) Turn assembly over on bench so that bolts (9) are up.

(16) Measure gaps between HP turbine vane segments (1) at 10 places. Gaps must be within limits (F & C REF. NO. 1808).

(17) Adjust gaps between segments by tapping the lug on inside diameter of vane, in the necessary direction, using a soft-faced drift.

CAUTION: KEEP BOLTS LOOSE SO THAT SEAL SUPPORT CAN MOVE FREELY.

(18) Install remaining 21 bolts (9).

NOTE: Bolts will be torqued after vane is installed.

(19) Tag and identify vane with engine serial number.

(20) Put vane on part stand until needed.

11. No. 3 Bearing Rear Cover and Carbon Seal

A. Removal (Ref. Fig. 412)

NOTE: If there is no evidence of oil leaks or obvious damage, removal of the No. 3 bearing cover is not required. If damage is evident or air/oil seal related problems have been experienced, proceed with these instructions.

(1) If turbine disk air nozzle (7) was not removed with the first-stage vane remove it now using puller (PWC43209).

(2) Remove HP turbine rotor air seal (8) using puller (PWC43357) and pad (PWC61823) or puller (PWC60177).

(3) Remove air seal damper (14) from HP turbine rotor air seal (8).

(4) Remove six bolts (9) securing bearing cover to gas generator/diffuser case (1).

(5) Remove No. 3 bearing rear cover (10) using puller (PWC43213).

(6) Inspect carbon seal (6) for damage (Ref. Inspection/Check). If no damage is present, do not remove carbon seal from rear cover assembly. If damage is found proceed as follows:

(a) Remove retaining ring (5).

CAUTION: HANDLE CARBON SEAL WITH CARE. ROUGH HANDLING CAN CAUSE DAMAGE OR RESULT IN AN OUT OF ROUND CONDITION.

(b) Remove carbon seal (6) using puller (PWC40323).

12. No. 3 Bearing Carbon Seal and Rear Cover Assembly

A. Installation of Carbon Seal in No. 3 Bearing Rear Cover (Ref. Fig. 413)

WARNING: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(1) Put No. 3 bearing rear cover assembly (1) in oven preheated to 177 to 204°C (350-400°F) for 15 minutes minimum.

(2) Put carbon seal (2) in freezer at -40°C (-40°F) for 15 - 30 minutes.

(3) Put support base (PWC43215) on arbor press.

WARNING: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(4) Remove No. 3 bearing rear cover (1) from oven and place it on support base (PWC43215).

(5) Remove carbon seal from freezer and and apply locking compound (PWC09-002) in area B.

CAUTION: HANDLE CARBON SEAL WITH CARE. ROUGH HANDLING CAN CAUSE DAMAGE OR RESULT IN AN OUT OF ROUND CONDITION.

(6) Install carbon seal assembly (2) in rear cover assembly (1) with snap washer (4) down, using drift (PWC43206). Make sure carbon seal was not damaged during installation.

(7) Secure carbon seal (2) in rear cover (1) with retaining ring (3).

(8) Put No. 3 bearing rear cover assembly (1) in a clean sealable container identified with the engine serial number.

B. Installation of No. 3 Bearing Rear Cover Assembly (Ref. Fig. 412)

(1) Heat flange of gas generator case for 15 minutes using a hot air heat gun.

(2) Install three guide pins (0.190 x 32 UNJF) threads equally spaced around flange. Put one guide pin in offset hole.

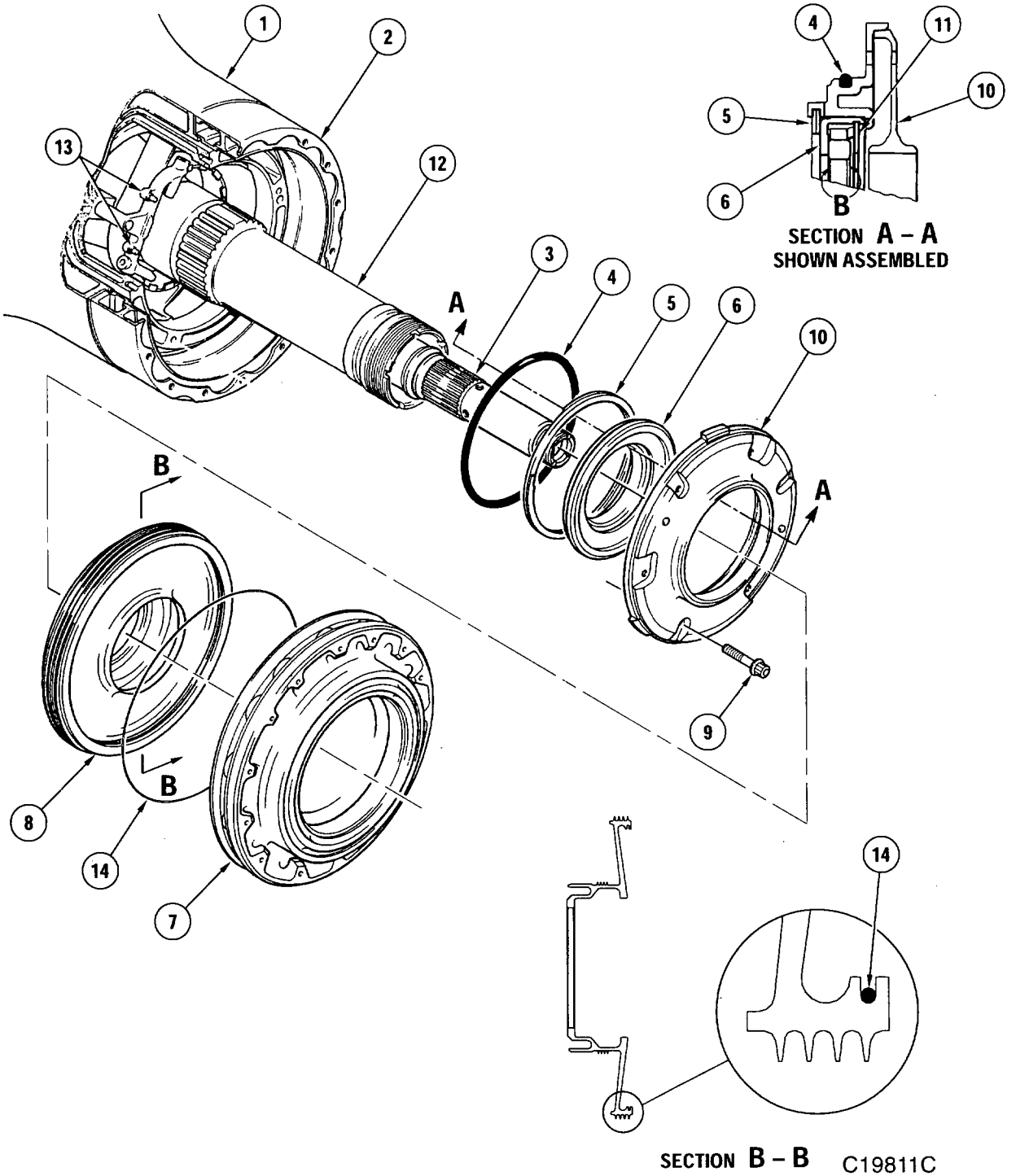
(3) Lubricate and install one new preformed packing (4) on No. 3 bearing rear cover assembly (10).

(4) Put a thin film of oil on face of carbon seal (6).

CAUTION: MAKE SURE LOCATING PINS ON OIL HOUSING ENGAGE WITH COVER BEFORE SEATING COVER.

(5) Install No. 3 bearing rear cover (10) on gas generator case (1) aligning offset hole. Make sure locating pins (13) on the oil housing engage with cover before seating the cover.

NOTE: A dental mirror can be used to check for engagement of locating pins with cover.



No. 3 Bearing Cover and HP Turbine Rotor Air Seal - Removal/Installation
Figure 412

Key to Figure 412

1. Gas Generator/Diffuser Case (Ref.)
2. Air Seal Support Assembly (Ref.)
3. LP Shaft (Ref.)
4. Preformed Packing
5. Retaining Ring
6. No. 3 Bearing Rear Carbon Seal
7. Turbine Disk Air Nozzle
8. HP Rotor Air Seal
9. Bolt
10. No. 3 Bearing Rear Cover Assembly
11. Snap Washer (Ref. part of Carbon Seal Assembly)
12. Compressor Rotor Stub Shaft (Ref.)
13. Alignment Pins (No. 3 Bearing Oil Housing)
14. Air Seal Damper

(6) Gradually seat No. 3 bearing rear cover assembly (10) using three bolts (9). Remove guide pins.

(7) Torque six bolts (9) in a star pattern 36 to 40 lb.in. (4.0-4.6 nm).

(8) Allow assembly to reach room temperature then and retorque to 36 to 40 lb.in. (4.0-4.6 Nm).

13. HP Turbine Rotor Air Seal

A. Installation of HP Turbine Rotor Air Seal (Ref. Fig. 412)

(1) Install air seal damper (14) to HP rotor air seal (8) aligning the damper ring gap with the V-mark on the HP rotor air seal (8).

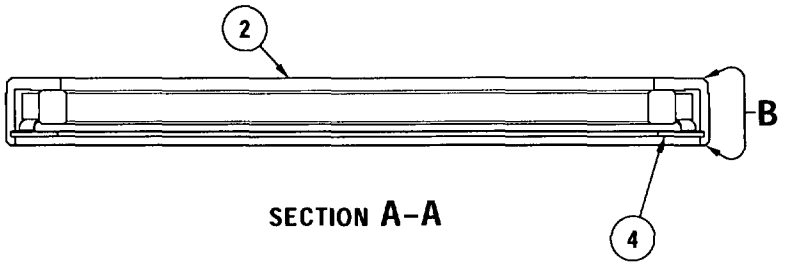
(2) Locally heat inside diameter of HP rotor air seal (8) for ten minutes using a suitable heat gun.

CAUTION: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS

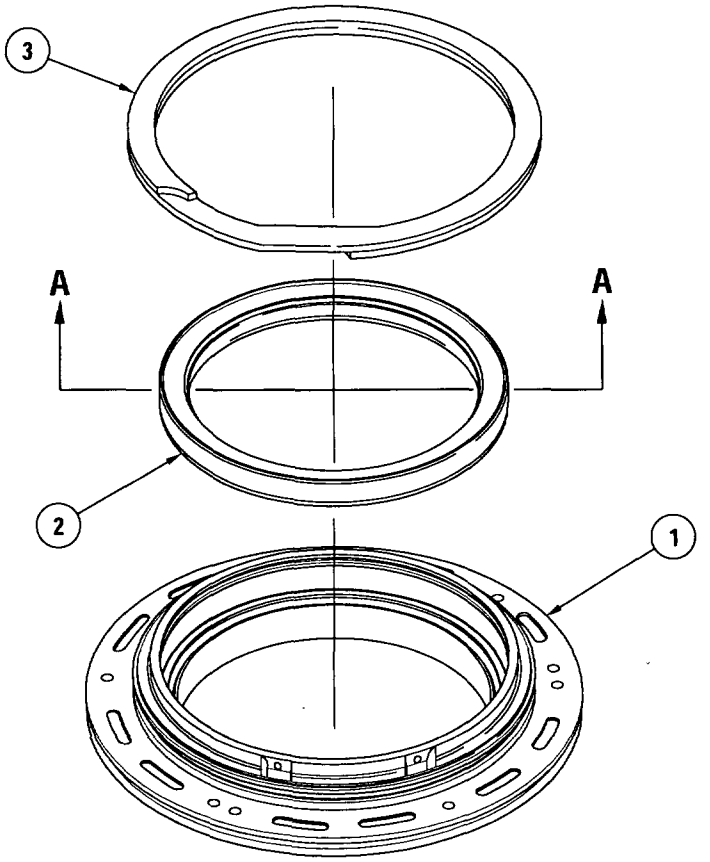
(3) Pre-SB24425: Align "X" mark on rotor air seal (8) with master spline on compressor rotor stub shaft (12).

(4) Post-SB24425: Align "X" mark on rotor air seal (8) with scallop in the rear face of compressor rotor stub shaft (12).

(5) Install rotor air seal with pusher (PWC60014). Maintain steady pressure until temperatures equalize.



SECTION A-A



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Carbon Seal in No. 3 Bearing Rear Cover - Installation
Figure 413

Key to Figure 413

1. No. 3 Bearing Rear Cover Assembly
2. No. 3 Bearing Carbon Seal
3. Retaining Ring
4. Snap Washer

14. HP Turbine Housing Assembly - Refurbishment

A. Measure the Circular Runout at Flange E (Ref. Fig. 414)

(1) Install runout fixture (PWC60101) (2) with V at Top Center on flange E of combustion chamber outer case (1), align offset hole at top centre. Secure using four slave 0.250 diameter nuts and bolts. Torque 85 to 95 lb.in. (9.6-10.7 Nm).

(2) Install runout gage (PWC60102) (4) on stub shaft (6). Secure using nut (PWC60102-10) (5) hand tight.

CAUTION: DO NOT LOAD STUB-SHAFT IN ANY DIRECTION DURING RUNOUT CHECK.

(3) Put DTI (3) at top center and set dial to zero.

(4) Turn stub-shaft (6) clockwise, two full turns, to make sure DTI returns to zero at top center (Ref. View F).

(5) Measure and record the indicated runout at following positions (Ref. View F):

(a) 90 Degrees =

(b) 180 Degrees =

(c) 270 Degrees =

(6) Calculate and record the offset on the horizontal axis as follows:

$$\text{Offset on horizontal axis} = \frac{(\text{Runout 90 Degrees}) - (\text{Runout 270 Degrees})}{2}$$

(7) Pre-SB24201: Calculate and record the offset on the vertical axis as follows:

$$\text{Offset on vertical axis} = \frac{(0.006 \text{ inch}) - (\text{Runout 180 Degrees})}{2}$$

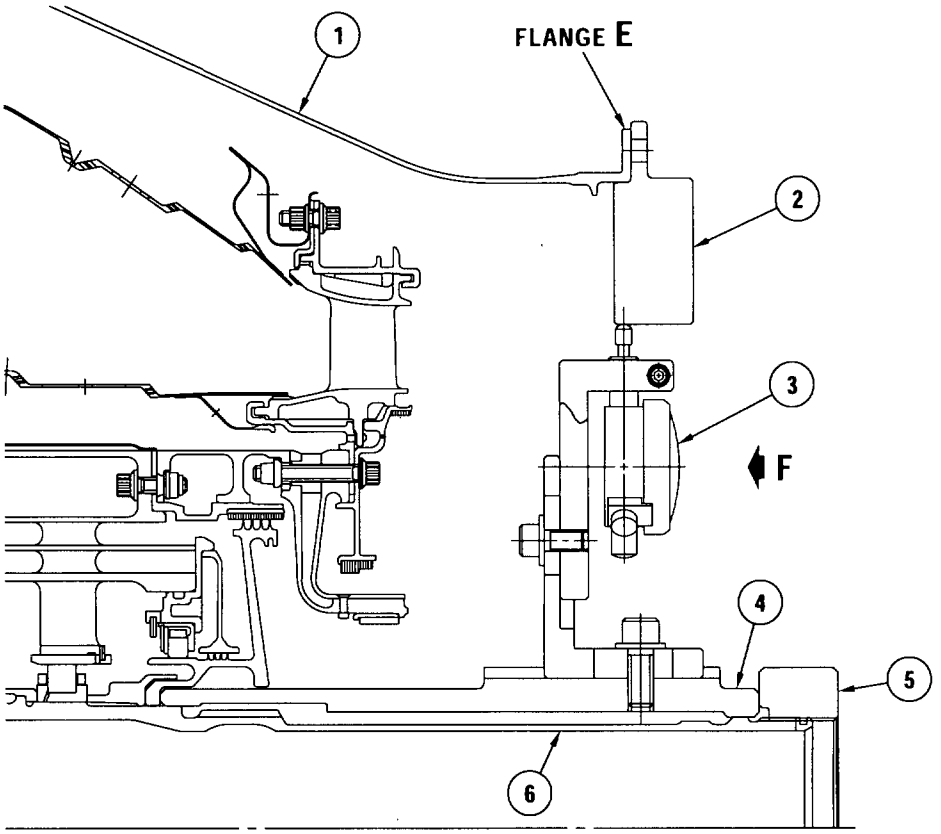
NOTE: 0.006 inch is the rotor shaft "droop" compensation factor.

(8) Post-SB24201: Calculate and record the offset on the vertical axis as follows:

$$\text{Offset on vertical axis} = \frac{(0.004 \text{ inch}) - (\text{Runout 180 Degrees})}{2}$$

NOTE: 0.004 inch is the rotor shaft "droop" compensation factor.

(9) Remove runout gage (4) and adapter ring (2).



C32280

Measurement of Runout at Flange E
Figure 414

Key to Figure 414

1. Combustion Chamber Outer Case Assembly
2. Runout Fixture(PWC60101)
3. Run Out Gage (PWC60102)
4. Runout Gage (PWC60102)
5. Nut (PWC60102-10)
6. Compressor Rotor Stub Shaft

B. Installation of Baffle (Ref. Fig. 420)

(1) Freeze baffle (9) to −40°C (−40°F).

(2) Put HP turbine housing (10) on work bench.

(3) Locally heat baffle around Diameter D using a hot air heat gun.

(4) Install baffle (9) on turbine housing (10) using drift (PWC43072) and a soft face hammer.

NOTE: Tap lightly in star pattern.

C. Machining of Second-stage Turbine Stator Assembly (Post-SB24135 or Post-SB24419) (Ref. Fig. 404)

(1) Mask any exposed openings in vane area using masking tape (PWC05-068) to prevent any metal particles from entering vane cavities.

(2) Find X marked offset hole on flange E of HP turbine housing (6). Temporarily identify offset hole on both sides of flange E, using an approved marker.

(3) Put second-stage turbine stator assembly (7) on bench with trailing edges down.

(4) If required vibropeen an X on one anti-rotation lug on the outside diameter of the second-stage turbine vane ring, to a depth of 0.003 - 0.006 and 0.010 high (Ref. View A).

(5) Put turbine housing (6) on bench, flange E down, over stator assembly (7).

(6) Lift turbine stator assembly (7) into place, guiding anti-rotation lugs through turbine housing (5).

(7) Engage the X marked anti-rotation lug on turbine stator assembly (7) with the X marked lugs of the turbine housing (5) that are in line with the offset hole in flange E (Ref. View B). Push turbine stator assembly down to lock it into place.

(8) Put an equal number of shims between the stator lugs and the turbine housing at four equally spaced locations to centralize the stator and remove any radial movement.

(9) Install one slave first-stage turbine shroud segment (4) in the turbine housing (5), at each shimmed lug position.

(10) Install shroud retaining ring (1).

(11) Put an equal number of shims between the first-stage turbine shroud segment (4) and the turbine stator assembly (7) at four equally spaced locations to remove any axial movement.

(12) Install HP turbine housing on grinding fixture (PWC60738).

(13) Install grinding fixture (PWC60122) on grinding machine.

(14) Offset HP turbine housing on vertical axis to the offset requirements as determined at Para. 14. A.

(15) Offset HP turbine housing on horizontal axis to offset the requirements as determined at Para. 14. A.

CAUTION: THIS DIAMETER WILL BE USED AS A DATUM FOR MACHINE SETUP.

(16) Machine the inside diameter of the turbine stator seal to obtain Fits and Clearances REF. NO. 1159.

(17) Remove turbine housing assembly from grinding fixture.

(18) Remove shroud retaining ring (1).

(19) Remove four shroud segments (4).

(20) Remove turbine stator assembly (7).

(21) Install turbine stator assembly (7) on grinding fixture (PWC60122).

(22) Install grinding fixture (PWC60122) on grinder centering turbine stator assembly (7) with grinding machine center.

(23) Machine turbine stator assembly diameters (Fits and Clearances REF. NOs. 1155 and 1157).

D. Installation of Post-SB24419 Second-stage Turbine Stator Assembly

NOTE: The following procedure is for a new vane ring.

(1) Measure dimension "DB" on the HPT first-stage disk assembly at four locations as shown (Ref. Fig. 415).

NOTE: Measure the dimension to the blade or the disk, whichever is furthest rearward.

(2) Make sure the HPT spacer is not installed.

(3) Install the HPT spacer gauge (PWC60791) onto the stub shaft as shown (Ref. Fig. 415). Secure the nut handtight.

(4) Make sure the HPT shaft is loaded rearward.

(5) Measure the dimension "FG".

(6) Determine the actual distance from the flange to the balance piston as follows:

"GB" - "FG" = "FB"

NOTE: The dimension "GB" is marked on the HPT spacer gauge (PWC60791).

(7) Measure the HPT spacer thickness.

(8) Determine the flange to disk dimension as follows:

"FD" = "FB" - ("DB" + HPT spacer thickness)

(9) To prepare the HPT stator assembly for machining, install the stator assembly in the new or modified HPT shroud housing assembly as follows:

(a) Put turbine stator assembly on bench with vane leading edges up.

(b) Put turbine housing on bench with flange E down, over stator assembly.

(c) Install an equal amount of 0.003 in. thick brass shims over all housing slots as shown at location R (Ref. Fig. 416). Use minimum amount of wax (PWC06-015) to hold the shims in place.

(d) Lift stator assembly into place in turbine housing by guiding stator positioning lugs through housing.

(e) While the stator assembly is still in free state, rotate the stator until the x-mark on the stator is aligned with the x-mark on the housing. Push stator down to lock into position.

(f) Install four slave shroud segments in turbine housing at four equally spaced locations.

(g) Install shroud retaining ring.

CAUTION: MAKE SURE THAT PARTS ARE SEATED.

(h) Install shim stock at location S (Ref. Fig. 416) between stator and shroud segments to remove any axial movement.

(i) Install housing assembly on fixture (PWC60738).

(10) Measure dimension "FV" as shown (Ref. Fig. 417) at four equally spaced locations.

(11) Determine the actual gap as follows:

"FD" - "FV" = ACTUAL GAP
The actual gap required is 0.075 - 0.080 in. (Ref. Fits and Clearances REF. NO. 1390).

(12) If the stator must be machined to achieve the actual gap, remove from the HPT shroud housing assembly and install it in the machining fixture (PWC60122).

NOTE: This fixture is the same one used in the offset grinding operation.

(13) Calculate the amount of material to be removed as follows:

0.075 - ACTUAL GAP = MATERIAL REMOVAL REQ'D

(14) Prior to machining, measure dimension "VB" as shown (Ref. Fig. 417) at four locations.

(15) Determine "VF req'd" as follows:

"VB" - MATERIAL REMOVAL REQ'D = "VF REQ'D"

(16) Machine stator to obtain required "VF". After machining measure "VF" at four locations (Ref. Fig. 417).

E. Calculation of Class of Second-stage Shroud Segments (Ref. Fig. 418)

(1) Measure and record Dim. D at offset hole position for No. 1 second-stage shroud segment (Ref. Section E-E).

(2) Continuing in a clockwise direction, measure and record Dim. D for remaining 17 second-stage shroud segment positions.

(3) Calculate and record Dim. A for each of 18 second-stage shroud segment locations as follows:

Dim. A = Dim. D – (Dim. C + Dim. B)

NOTE: Dim. B = The median second-stage turbine blade tip clearance.

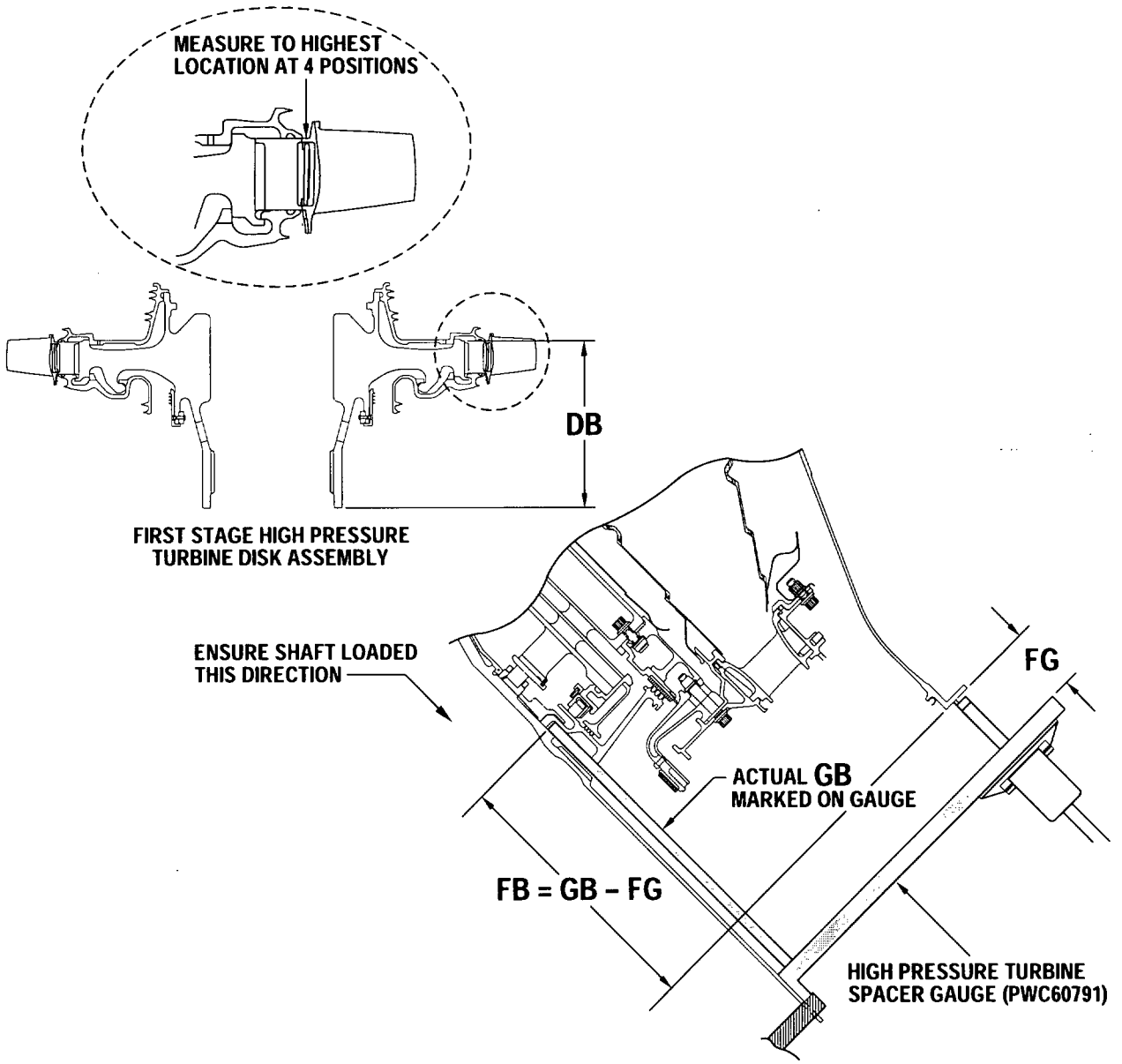
(4) Calculate and record Dim. E as follows:

Dim. E = (Dim. C + Dim. B)

(5) Determine required class of shroud segment for each of 18 positions, using HP Turbine Second-stage Shroud Classification Data Chart.

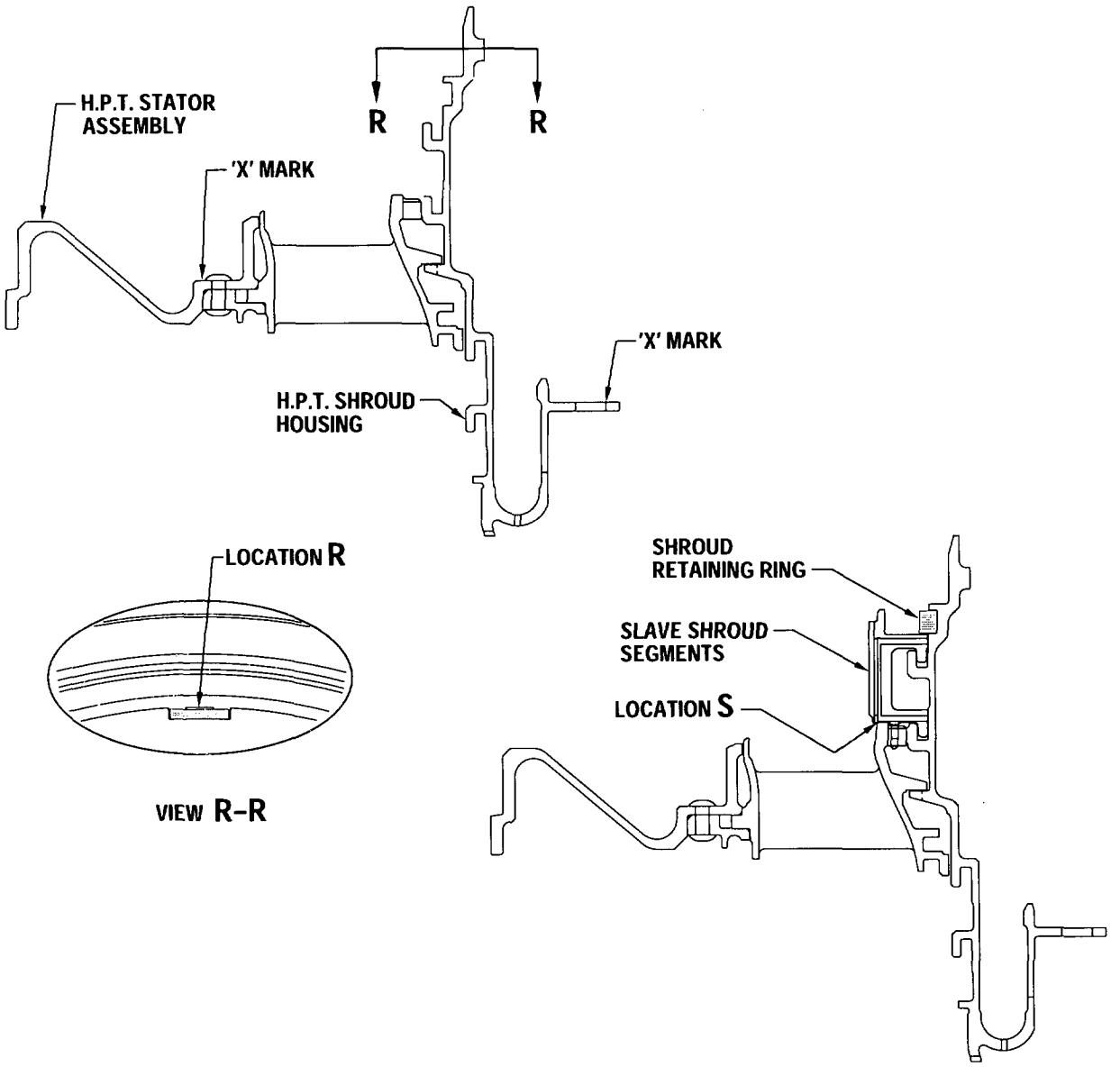
CAUTION: MAKE SURE NUMBER ONE SEGMENT IS AT TOP CENTER. CONTINUE NUMBERING IN CLOCKWISE DIRECTION.

(6) Temporarily identify each selected second-stage shroud segment with appropriate location No. from 1 to 18, using an approved marker.


MEASURE TO HIGHEST LOCATION AT 4 POSITIONS
DB
FIRST STAGE HIGH PRESSURE TURBINE DISK ASSEMBLY
ENSURE SHAFT LOADED THIS DIRECTION
FG
ACTUAL GB MARKED ON GAUGE
FB = GB – FG
HIGH PRESSURE TURBINE SPACER GAUGE (PWC60791)

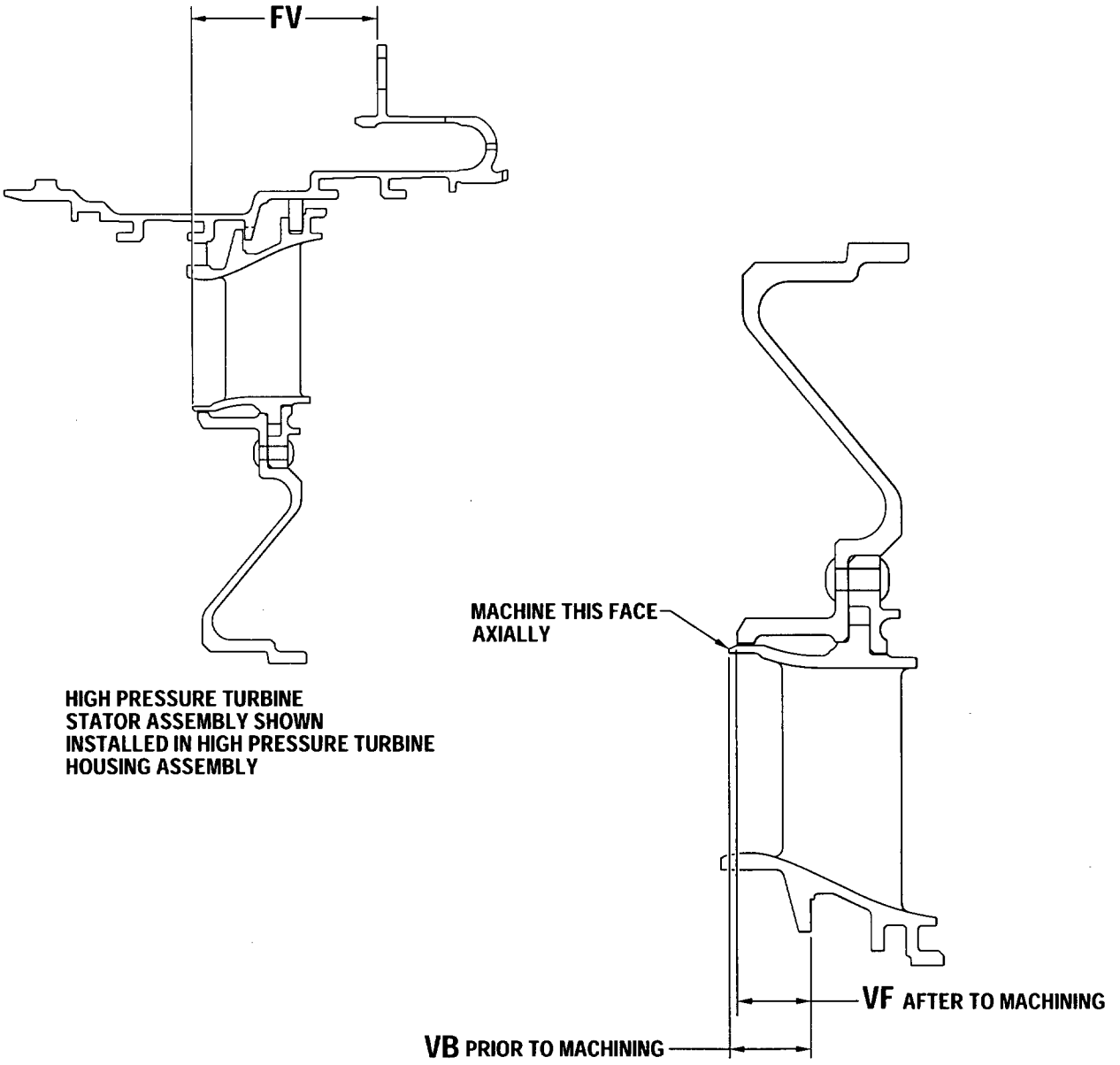
C37997

Post-SB24419 Measurement of Actual Gap at HPT Stator Assembly
Figure 415



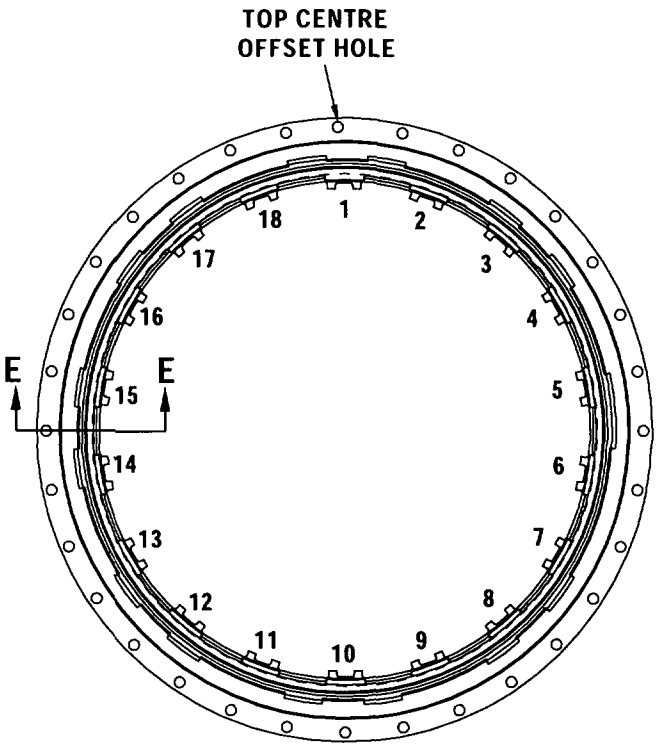
C39130

Post-SB24419 Preparation of HPT Stator Assembly for Machining
Figure 416

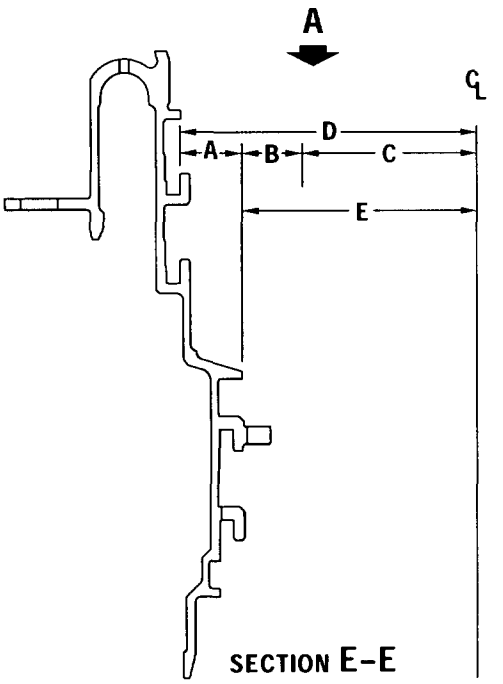


C37998

Post-SB24419 Machining of HPT Stator Assembly
Figure 417



VIEW A
HP TURBINE HOUSING
LOOKING FORWARD

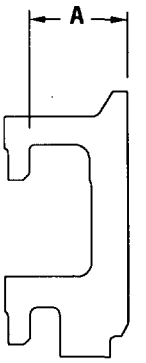


SECTION E-E

LEGEND

DIM. A = DIMENSION OF REQUIRED SHROUD CLASS
DIM. B = MEDIAN SECOND STAGE TURBINE BLADE TIP CLEARANCE REF. TOL 1225
DIM. C = RADIUS OF SECOND STAGE HP TURBINE
DIM. D = HP TURBINE HOUSING RADIUS FOR SECOND STAGE HP TURBINE
DIM. E = MEDIAN SECOND STAGE TURBINE SHROUD GRINDING RADIUS

HP TURBINE SECOND STAGE SHROUD CLASSIFICATION DATA



DIM. A		CLASS
OVER	TO	
.3659	.370	CL08
.370	.374	CL09
.374	.378	CL10
.378	.382	CL11
.382	.386	CL12
.386	.390	CL13
.390	.394	CL14
.394	.398	CL15
.398	.402	CL16
.402	.406	CL17
.406	.410	CL18
.410	.414	CL19
.414	.418	CL20

C32282

Calculation of Class of Second-stage Shroud Segments
Figure 418

F. Calculation of Class of First-stage Shroud Segments (Ref. Fig. 419)

(1) Measure and record Dim. I at offset hole position of No.1 first-stage shroud segment.

(2) Continuing in a clockwise direction Ref. view B, measure and record Dim. I for remaining 17 first-stage shroud segment positions.

(3) Calculate and record Dim. F for each of the 18 first-stage shroud segment locations as follows:

Dim. F = Dim. I – (Dim. G + Dim. H)

NOTE: Dim. G = The median first-stage turbine blade tip clearance.

(4) Calculate and record Dim. J as follows:

Dim. J = (Dim. G + Dim. H)

NOTE: Dim. J = Shroud grinding radius.

(5) Determine required class of shroud for each of 18 positions using HP Turbine First-stage Shroud Classification Data Chart.

CAUTION: MAKE SURE NUMBER ONE SEGMENT IS AT TOP CENTER. CONTINUE NUMBERING IN CLOCKWISE DIRECTION AS SHOWN REF. VIEW B.

(6) Temporarily identify each of first-stage shroud segments with appropriate location number from 1 to 18, using an approved marker.

G. Preparation for Installation of HP Turbine Shroud Segments (Ref. Fig. 420)

(1) Replace temporary assembly location numbers 1 to 18 on second-stage shroud segments (1) with permanent numbers by vibropeen method (Ref. Section A-A).

(2) Replace temporary assembly location numbers 1 to 18 on first-stage shroud segments (5) with permanent numbers by vibropeen method (Ref. Section B-B).

(3) If required identify location of offset hole on flange E with an X-mark by electrolytic etch.

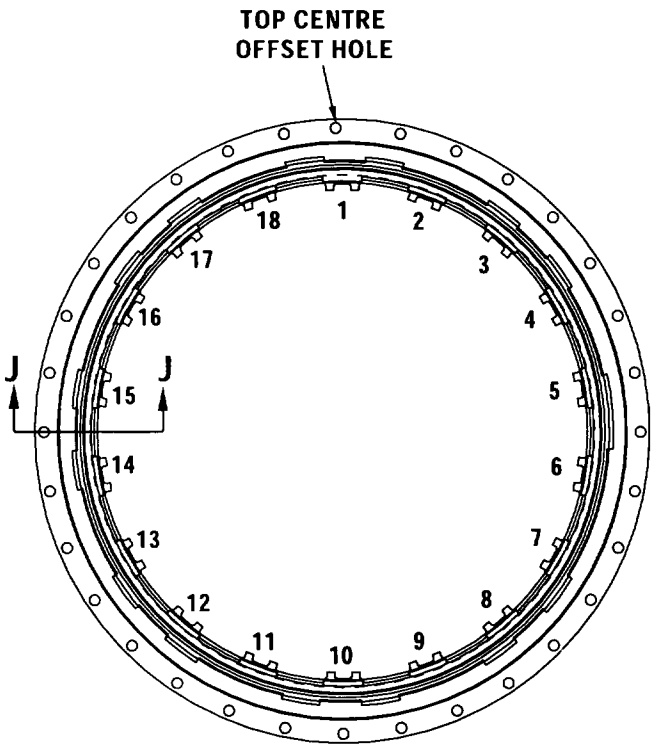
(4) Install two used seals (2) and one used seal (3) in 18 shroud segments (1).

NOTE: Seals (2, 3) retained from disassembly.

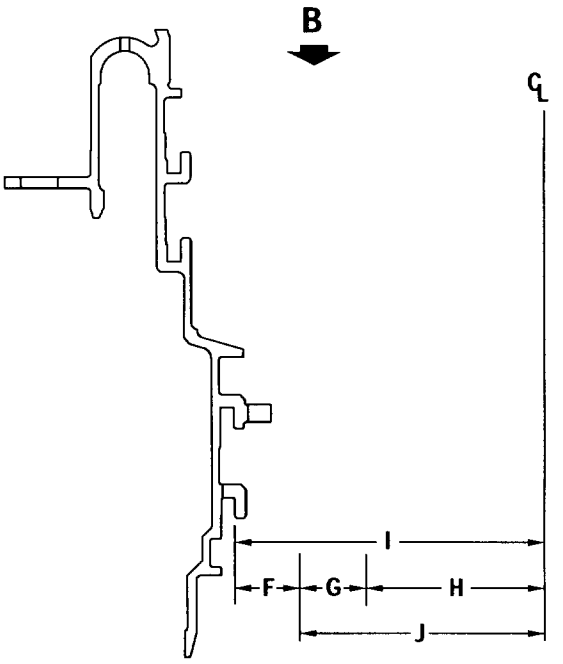
(5) Put shroud segment (1), identified as number one, on the work bench.

(6) Put shroud segment (1), identified as number two, on work bench at next clockwise position. Push shroud segments together engaging seals (2 and 3) (Ref. View A).

P&WC Proprietary Information. Subject to the restrictions on the title page.



VIEW B
HP TURBINE HOUSING
LOOKING FORWARD

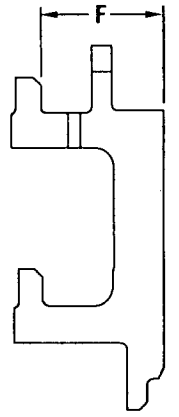


SECTION J–J

LEGEND

DIM. F = DIMENSION OF REQUIRED SHROUD CLASS
DIM. G = MEDIAN FIRST STAGE TURBINE BLADE TIP CLEARANCE REF. TOL 1225
DIM. H = RADIUS OF FIRST STAGE HP TURBINE
DIM. I = HP TURBINE HOUSING RADIUS FOR FIRST STAGE HP TURBINE
DIM. J = MEDIAN FIRST STAGE TURBINE SHROUD GRINDING RADIUS

HP TURBINE FIRST STAGE SHROUD CLASSIFICATION DATA



DIM. F		CLASS
OVER	TO	
.3659	.400	CL08
.400	.404	CL09
.404	.408	CL10
.408	.412	CL11
.412	.416	CL12
.416	.420	CL13
.420	.424	CL14
.424	.428	CL15
.428	.432	CL16
.432	.436	CL17
.436	.440	CL18
.440	.444	CL19
.444	.448	CL20

C32283

Calculate Class of First-stage Shroud Segment
Figure 419

(7) Continue to add remaining shroud segments, identified as numbers 3 to 18, in a similar manner.

NOTE: Do not join segment 1 to segment 18 at this time (Ref. View C).

(8) Put masking tape on inside diameter to keep shrouds together.

(9) Install two used seals (6) and one used seal (7) in 18 shroud segments (5).

NOTE: Seals (6, 7) retained from disassembly.

(10) Place shroud segment (5), identified as number one, on the work bench.

(11) Place shroud segment (5), identified as number two, on the work bench at the next counter clockwise position (Ref. View B). Push shroud segments together engaging seals (6, 7).

(12) Continue to add remaining shroud segments, identified as 3 to 18, in a similar manner.

NOTE: Do not join segment 1 to segment 18 at this time (Ref. View C).

(13) Masking tape on inside diameter can be used to keep shrouds together.

H. Assembly of HP Turbine Housing for Grinding (Ref. Fig. 421)

(1) Put vane ring adapter (PWC43064) (6) on bench with back face down.

(2) Put turbine housing (5) on bench over adapter (6), with flange E down.

(3) Lift vane ring adapter (6) into place, guiding adapter locating lugs through turbine housing (5).

(4) Engage vane ring adapter locating lugs with turbine housing lugs. Push adapter down to lock it into place.

(5) Put previously assembled first-stage turbine shroud segments (4) in turbine housing (5), aligning number one shroud segment with X-marked offset hole on flange E.

(6) Engage two seals (2) and one seal (3) with shroud segment (4) to join shroud segments 1 and 18.

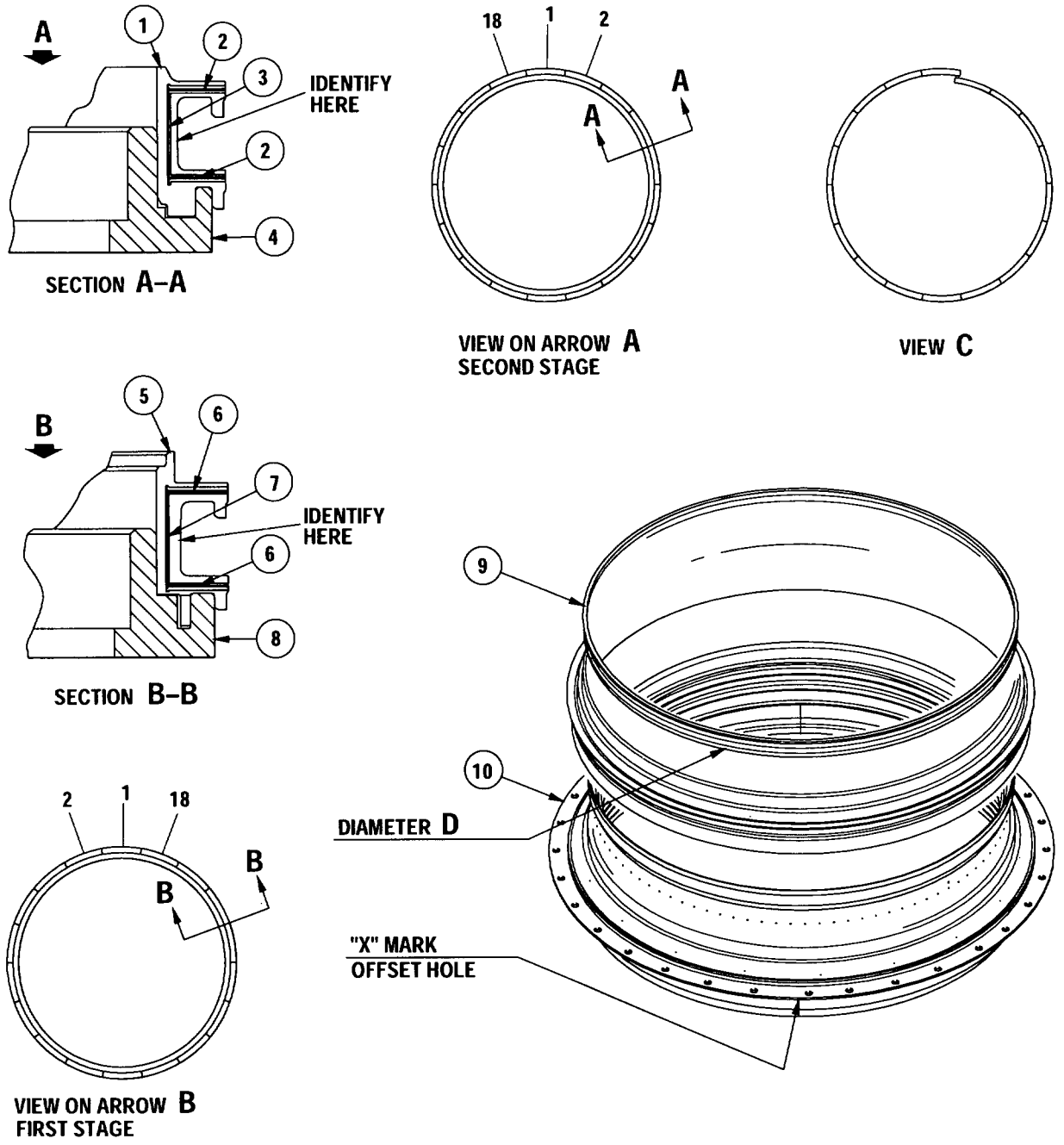
(7) Push shroud segments down, using a fiber drift, to seat them.

(8) Install shroud retaining ring (1).

(9) Put turbine housing (5) on bench with flange E up.

(10) Put previously assembled second-stage turbine shroud segments (9) in turbine housing (5), aligning number 1 shroud segment with offset hole on flange E.

(11) Engage two seals (8) and one seal (7) with shroud segment (9) to join shroud segments 1 and 18.



C31281

Preparation for Installation/Final Assembly of HP Turbine Shroud Segments
Figure 420

Key to Figure 420

1. Shroud Segment (Second-stage)
2. Seal
3. Seal
4. Holding Fixture
5. Shroud Segment (First-stage)
6. Seal
7. Seal
8. Holding Fixture
9. Baffle
10. HP Turbine Housing

(12) Push shroud segments into place using a fiber drift.

(13) Install shroud retaining ring (10).

(14) Measure gaps between first-stage shroud segments (4) (Fits and Clearances REF. NO. 1802).

(15) Measure gaps between second-stage shroud segments (9) (Fits and Clearances REF. NO. 1803).

I. Installation of Baffle (Ref. Fig. 420)

(1) Freeze baffle (9) to –40°C (–40°F).

(2) Put HP turbine housing (10) on work bench.

(3) Locally heat baffle around Diameter D using a hot air heat gun.

(4) Position baffle (9) over turbine housing (10).

(5) Lower baffle into position and seat using drift (PWC43072) and a soft face hammer.

NOTE: Tap lightly in star pattern.

J. Grinding of HP Turbine Shroud Segments (Ref. Fig. 422)

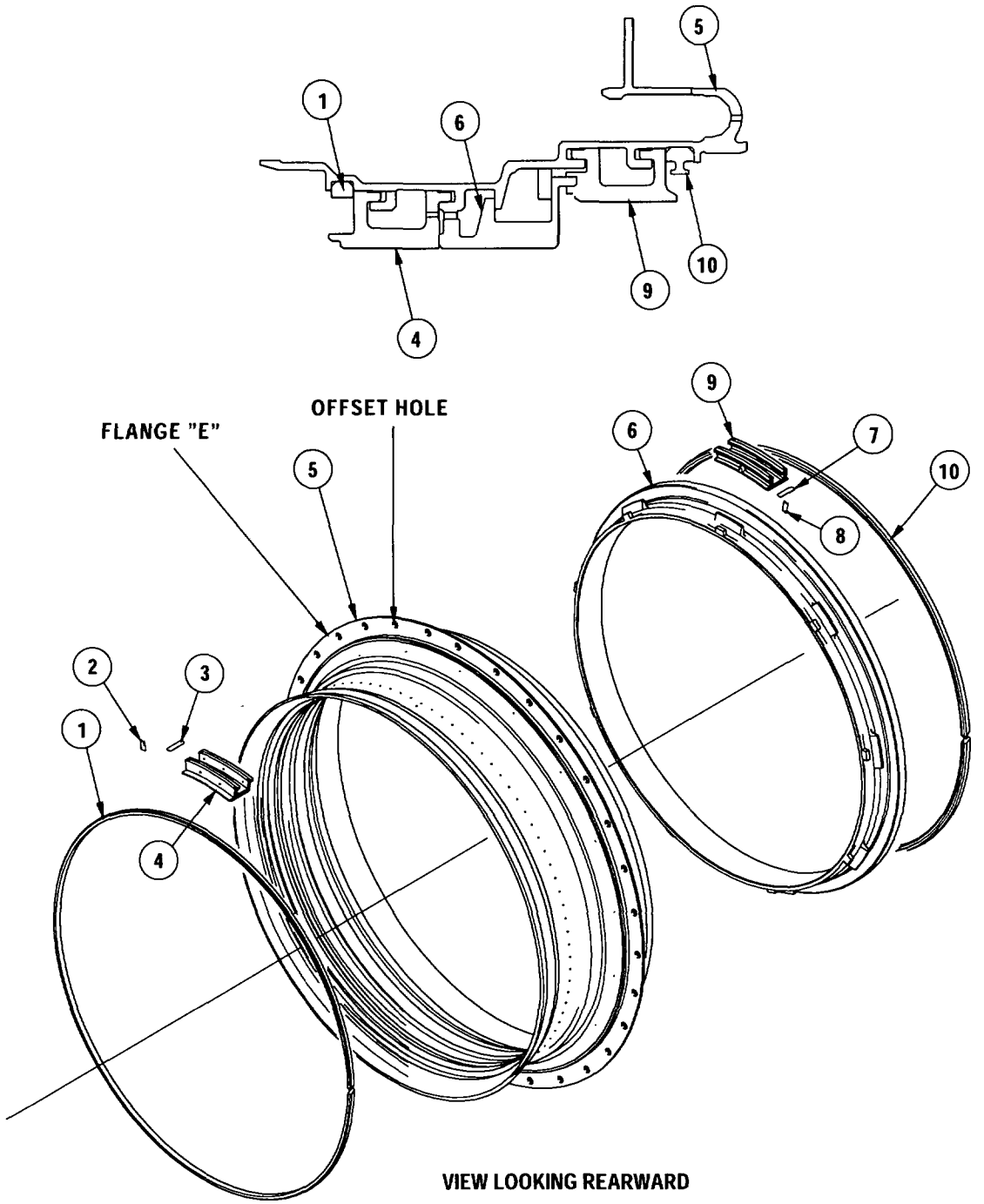
(1) Install HP turbine housing assembly (1) on holding fixture (PWC43063).

(2) Install holding fixture on grinding machine.

(3) Adjust holding fixture to offset grind to requirements as determined at Para. 14. A. as follows.

CAUTION: DO NOT GRIND FIXTURE (5).

(4) Grind first-stage shroud segments to Dim. J (Ref. Para. 14.F.).



C31280

Assembly of HP Turbine Housing for Grinding
Figure 421

Key to Figure 421

1. Shroud Retaining Ring
2. Seal
3. Seal
4. Shroud Segment (First-stage)
5. HP Turbine Housing
6. Vane Ring Adapter (PWC43064)
7. Seal
8. Seal
9. Shroud Segment (Second-stage)
10. Shroud Retaining Ring

CAUTION: DO NOT GRIND FIXTURE (5).

(5) Grind second-stage shroud segments to Dim. A (Ref. Para. 14.E.). Check for witness steps after grinding.

(6) Remove HP turbine housing assembly from grinding fixture.

K. Disassembly After Grinding (Ref. Fig. 421)

(1) Put turbine housing (5) on bench with flange E facing up.

(2) Remove shroud retaining ring (10).

(3) Remove 18 shroud segments (9) from turbine housing (5) as follows:

(a) Pull all segments up to disengage locking feature.

(b) Pull one segment into center of turbine housing.

(4) Remove and discard 36 seals (8) and 18 seals (7).

(5) Set turbine housing (5) on bench with flange E facing down.

(6) Remove shroud retaining ring (1).

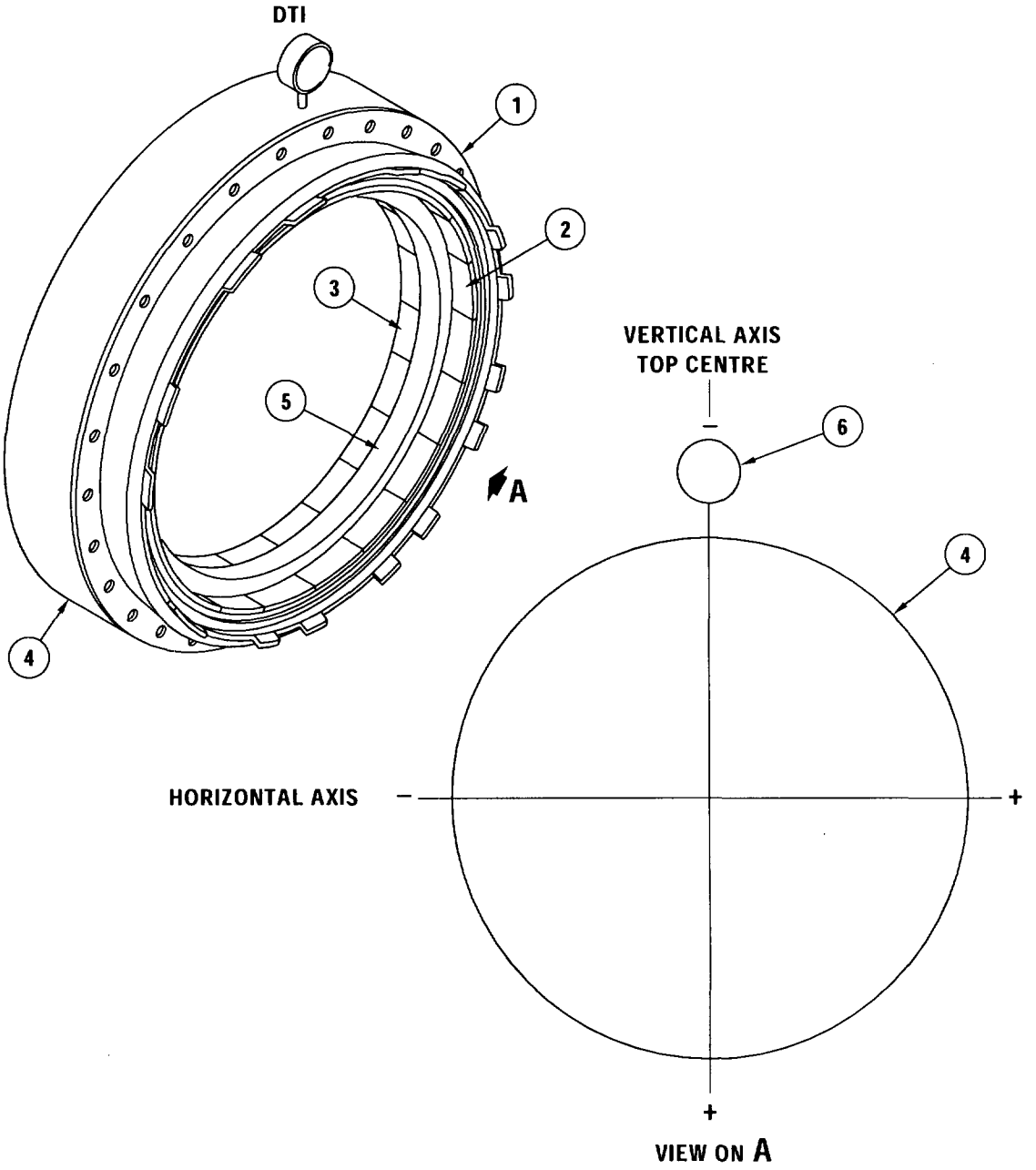
(7) Remove 18 shroud segments (4) from turbine housing (5) as follows:

(a) Pull all segments up, to disengage locking feature, using puller (PWC60071) and then remove puller.

(b) Pull one segment into the center of the turbine housing.

(8) Separate 18 shroud segments (4). Remove and discard 36 seals (2) and 18 seals (3).

(9) Pull vane ring adapter (6) up to disengage locking feature, then turn it clockwise and lower it to table.



C32281

Grinding of HP Turbine Shroud Segments
Figure 422

Key to Figure 422

1. HP Turbine Housing Assembly
2. Second-stage HP Turbine Shroud Segment
3. First-stage HP Turbine Shroud Segment
4. Grinding Fixture (Turbine Housing) (PWC43063)
5. Adapter (Slave Second-stage Vane) (PWC43064)
6. Dial Test Indicator (DTI)

(10) Remove baffle (5) using puller (PWC43071) (Pre-SB24103) or (PWC60139) for all other baffles.

WARNING: WEAR EYE PROTECTION.

(11) Clean all parts using petroleum solvent (PWC11-027) spray and dry with shop air. (Ref. Cleaning).

L. *Preparation for Final Assembly* (Ref. Fig. 420)

(1) Put two new seals (2) and one new seal (3) in 18 shroud segments (1). Install seals with open loops to inside.

(2) Put shroud segment (1), identified as number one, on bench.

(3) Install shroud segment (1), identified as number two, on bench at next clockwise position. Push shroud segments together, engaging seals (2) and (3) (Ref. View A).

(4) Continue to add remaining shroud segments, identified with numbers 3 to 18, in a similar manner.

NOTE: Do not join segment 1 to segment 18 at this time (Ref. View C).

(5) Put masking tape (PWC05-068) around the inside diameter to keep shrouds together.

(6) Install two new seals (6) and one used seal (7) in 18 shroud segments (5). Install seal with open loops to inside.

(7) Put shroud segment (5), identified as number one, on bench.

(8) Place shroud segment (5), identified as number two, on bench at next counter clockwise position (Ref. View B). Push shroud segments together engaging seals (6, 7).

(9) Continue to add remaining shroud segments, identified with numbers 3 to 18, in a similar manner.

NOTE: Do not join segment 1 to segment 18 at this time (Ref. View C).

(10) Put masking (PWC05-068) tape around the inside diameter to keep shrouds together.

M. Assembly of HP Turbine Housing (Ref. Fig. 404)

(1) Put seal ring (8) in HP Turbine housing (6) and check circumferential gap (Ref. HP Turbines - Inspection/Check).

(2) Put turbine stator assembly (7) on bench with vane leading edges up. Install seal ring (8) in turbine stator with face identified "PRESS" facing up.

(3) Put turbine housing (6) on bench with flange E down, over stator assembly (7).

(4) Lift stator assembly (7) into place in turbine housing (6) by guiding stator positioning lugs through housing.

(5) Engage the X-marked stator lug with the turbine housing lugs in line with offset hole on flange E (Ref. Views A and B). Push stator down to lock into position.

(6) Put previously assembled shroud segments (4) in turbine housing (6), aligning number one shroud segment with X-marked offset hole (Ref. View B).

(7) Engage two seals (3) and one seal (2) with shroud segment (4) to join shroud segments 1 and 18.

(8) Push shroud segments into place using a fiber drift.

(9) Install shroud retaining ring (1).

(10) Put turbine housing (6) on bench with flange E up.

(11) Put previously assembled shroud segments (11) in turbine housing (6), aligning number one shroud segment with offset hole on flange E.

(12) Engage two seals (10) and one seal (9) with shroud segment (11) to join shroud segments 1 and 18.

(13) Push shroud segments into place using a fiber drift.

(14) Install shroud retaining ring (12).

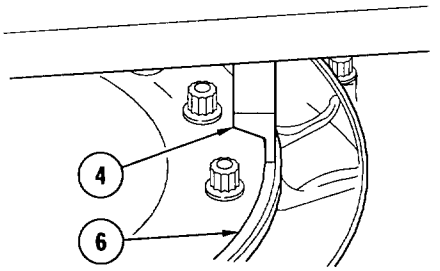
15. HP Turbine Spacer

A. Calculation HP Turbine Spacer Thickness (Ref. Fig. 423)

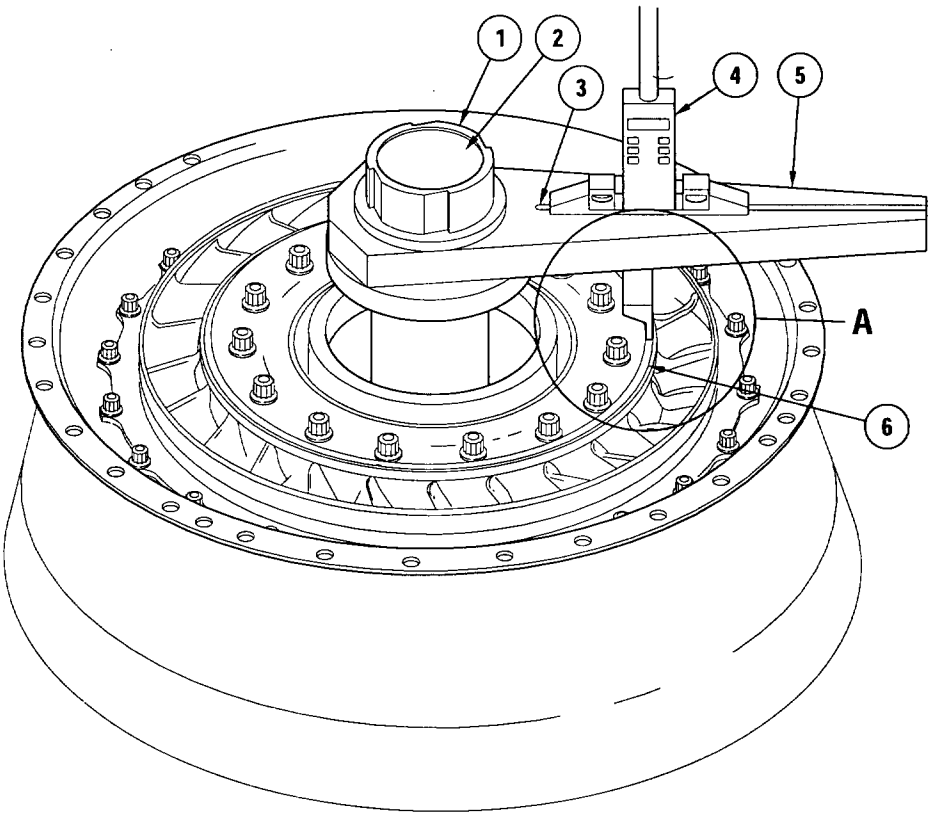
(1) Make sure the contact face of the high turbine rotor air seal (9) and spacer gage (3) are clean and free of foreign material or damage.

(2) Find dimension 6.5XX marked on the side of spacer gage (3). Record as Dim. G.

(3) Install spacer gage (3) on compressor rotor stub shaft (2). Attach using nut (1).



DETAIL A

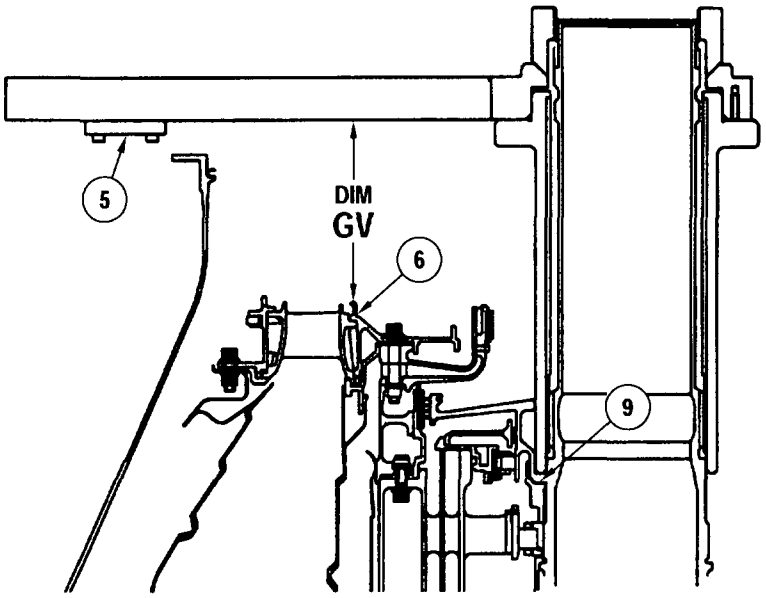


C75359

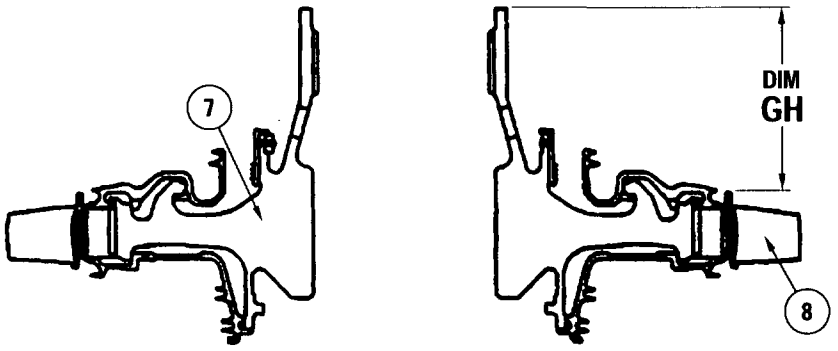
Calculation of HP Turbine Spacer Thickness
Figure 423 (Sheet 1 of 2)

Key to Figure 423

1. Compressor Rotor Stub Shaft
2. Nut (Part Of Item 3)
3. Spacer Gage (PWC60791)
4. Depth Vernier
5. Plate (Part Of Item 3)
6. Stator Air Seal
7. First-stage HP Turbine Disk Assembly
8. First-stage HP Turbine Blade
9. HP Turbine Rotor Air Seal



SECTION B-B



RANDOM SECTION THROUGH
FIRST-STAGE HP TURBINE

C75382

Calculation of HP Turbine Spacer Thickness
Figure 423 (Sheet 2)

(4) Measure the distance from the rear face of plate (5) to the rear of stator air seal (6). Measure at four equally spaced positioned around the air seal and record the average as Dim. GV.

(5) Measure the distance from the front face of first-stage HP turbine disk (7) to front platform of turbine blade (8). Measure at four equally spaced positions around the turbine and record the average as Dim. GH.

(6) Calculate the HP turbine spacer thickness using the equation

Spacer Thickness = (Dim. G - Dim. GV) - (Dim. GH + 0.060) where:

Dim. G =	The dimension recorded at step (2).
Dim. GV =	The dimension recorded at step (4).
Dim. GH =	The dimension recorded at step (5).
0.060 =	The average necessary immersion dimension (F&C REF. NO. 1284).

B. Grinding of Spacer (Ref. Fig. 424)

(1) If available, obtain spacer of required thickness, tag identify with thickness and seal in plastic bag.

(2) If spacer of required thickness is not available, choose a thicker spacer and grind to size.

(a) Grind Face D only to achieve required thickness ± 0.001 inch and surface finish of 63 microinches.

(b) Spacer faces must be flat within 0.002 inch and Face D must be parallel to Face B within 0.0002 inch.

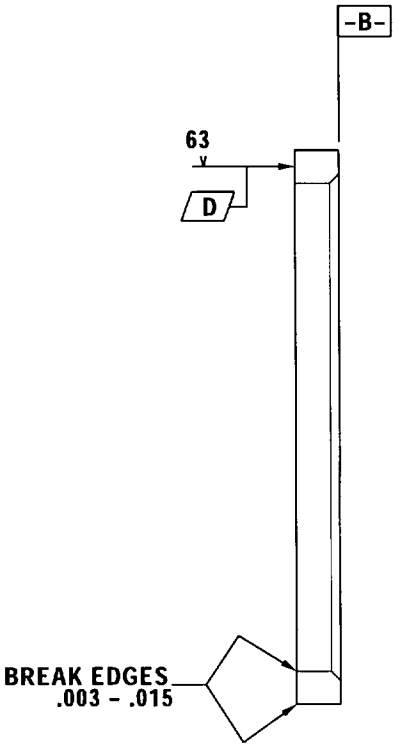
(c) Break edges of spacer 0.003 to 0.015 inch.

(d) Magnetic particle inspect: rod 1000 amps. No cracks are permitted.

(e) Spray wash spacer using petroleum solvent (PWC11-027) and air dry.

(f) Check for residual magnetism using a standard field gage. Negate any residual magnetism.

(g) Tag identify with thickness and seal spacer in plastic bag.



C75357

Grinding Of Spacer
Figure 424

16. HP Turbine Trim Balancing

A. Installation of Trim Balance Weights (Ref. Fig. 425)

CAUTION: ENGINE BALANCING PROCEDURES REQUIRE THAT THE COMPRESSOR ROTOR BALANCE BE OBTAINED BY MAKING TRIM ADJUSTMENTS TO THE HP TURBINES. THE FOLLOWING SPECIAL ASSEMBLY TECHNIQUES MAY THEREFORE BE NECESSARY FOR FIELD INSTALLATION OF REPLACEMENT TURBINES.

(1) Find the location and class of any necessary trim balance counterweight by referring to the engine trim data plate located on accessory gearbox. Refer to the trim code definition for planes G and D (Ref. Fig. 425). Examine the trim plate and how it relates to the trim weights installed on planes D and G of the HP turbines (Ref. Sht. 2).

CAUTION: IF THE INFORMATION RECORDED ON THE ENGINE TRIM DATA PLATE IS DIFFERENT FROM THE INFORMATION RECORDED IN THE ENGINE LOG BOOK CONTACT P&WC CUSTOMER SUPPORT.

(2) If a reference cannot be found on the trim data plate check the engine log book. If there is no reference in engine log book, then no trim balancing is necessary.

CAUTION: IF A DETAIL BALANCE WEIGHT IS INSTALLED WHERE A TRIM WEIGHT IS NECESSARY THE ASSEMBLY MUST BE REBALANCED TO ALLOW FOR INSTALLATION OF TRIM BALANCE WEIGHT.

(3) Install trim weights on replacement HP turbines if necessary, as follows (Ref. Fig. 425):

(a) Install any necessary trim balance weights on correction plane G, in the same positions as recorded on the trim data plate.

NOTE: 1. Pre-SB24425: Position number one is in line with the master spline of the first-stage turbine.

NOTE: 2. Post-SB24425: Position number one is in line with the scallop of the first-stage turbine.

(b) Secure counterweights with rivets inserted from the inside diameter. Upset rivets using riveter (PWC60387), set (PWC30304-35) and set (PWC30304-41).

(c) Install any necessary trim balance weights on correction plane D, in the same positions as recorded on the trim data plate.

NOTE: 1. Pre-SB24425: Position number one is in line with the V mark on HPT2 or the master spline of HPT1.

NOTE: 2. Post-SB24425: Position number one is in line with the V mark on HPT2 or the scallop of HPT1.

(d) Secure counterweights with rivets inserted from the inside. Upset rivets using riveter (PWC43661) and set (PWC30304-23).

17. First-stage HP Turbine

A. Installation

(1) DELETED

18. HP Turbine Housing

A. Installation (Ref. Fig. 426)

(1) DELETED

19. Second-stage HP Turbine

A. Installation (Ref. Fig. 427)

(1) DELETED

20. HP Turbine Module Installation (Ref. Fig. 428)

A. Assemble HP Turbine Module

(1) If necessary install adapter plate (PWC60923) on build stand revolving ring (PWC60377). Attach using four bolts.

(2) Install holding fixture (PWC43053) (7) on adapter plate. Attach using four bolts.

(3) If necessary make a straight line starting at the center of holding fixture (7) and extending to the outside diameter using a silver pencil (PWC05-018).

(4) Clean the mating surfaces of the first and second stage HP turbines (4, 6) using alcohol (PWC11-014B) on a clean lint free wiper.

(5) Push clamp fingers (5) towards the center of fixture (7).

(6) Install first-stage turbine (6) on holding fixture (7) with the front face down as follows:

(a) Pre-SB24425: Align the master spline with the alignment mark on the fixture.

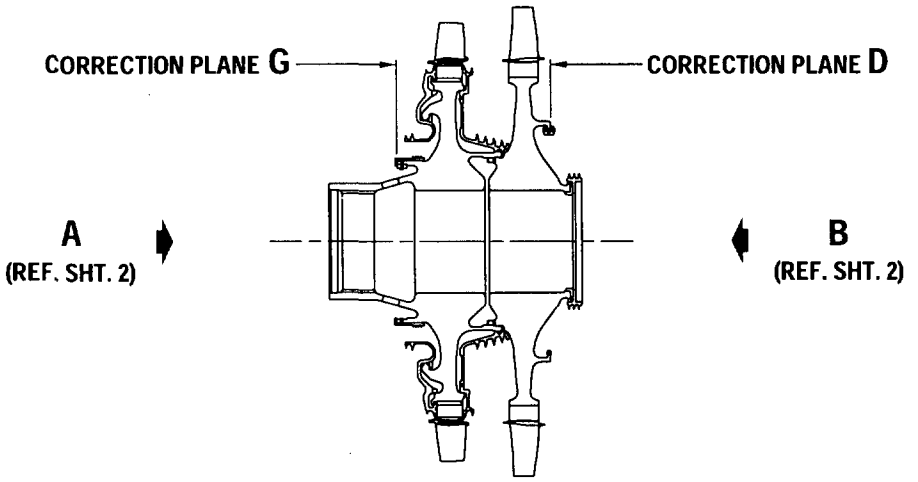
(b) Post-SB24425: Align the "V" mark on the front outside spigot diameter with the alignment mark on the fixture.

(7) Pull clamp fingers (5) out until the clamps engage turbine (6).

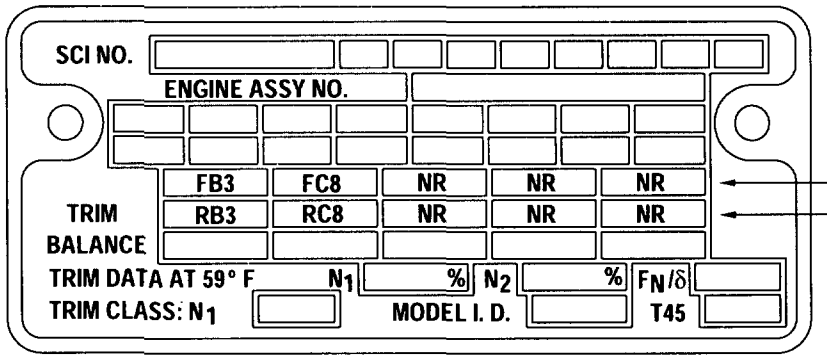
(8) Install HP turbine housing assembly (8) on holding fixture (7) with flange E up. Align the "X" marked offset hole in flange E with the alignment mark on fixture (7).

(9) Connect first-stage HP turbine heater (PWC61536) to one of two heater controllers (PWC67176) or (PWC60136).

(10) Put heater on the first-stage turbine (6).



HP TURBINE ROTOR BALANCING ASSEMBLY



THE HP TURBINE TRIM
IS RECORDED ON TRIM PLATE

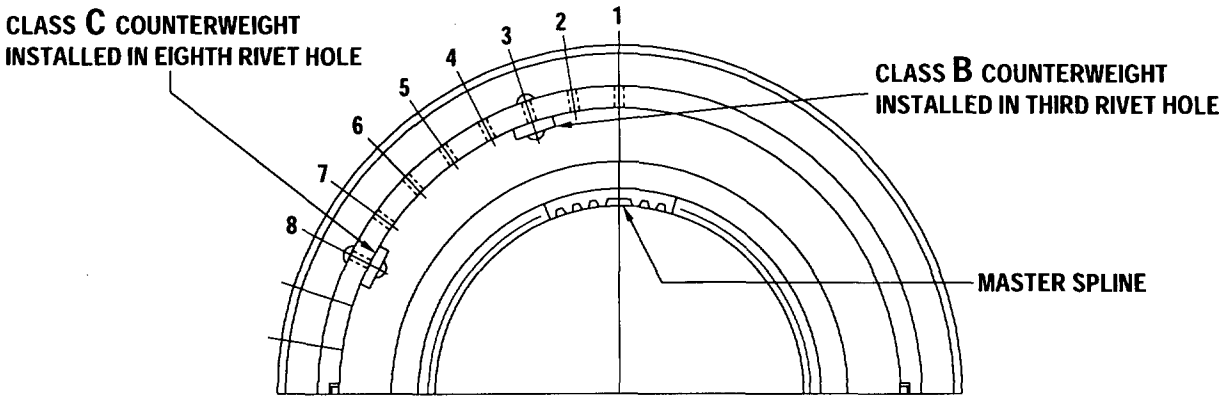
ENGINE TRIM DATA PLATE LOCATED ON AGB

HP TURBINE TRIM CODE DEFINITION

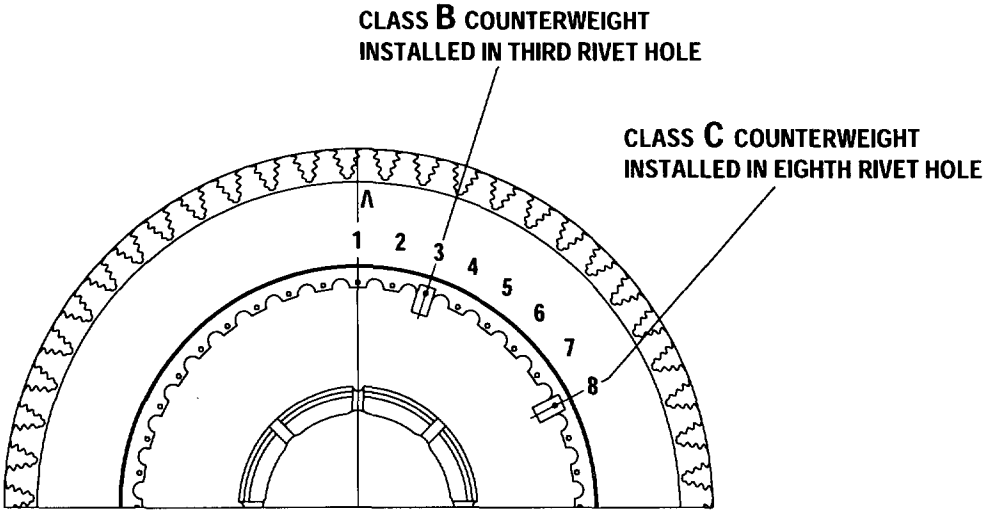
R - DENOTES TURBINE REAR FACE (PLANE D)
F - DENOTES TURBINE FRONT FACE (PLANE G)
A-G - DENOTES COUNTERWEIGHT CLASS
1-40 - DENOTES THE FIRST RIVET HOLE OCCUPIED BY A COUNTERWEIGHT IN THE DIRECTION OF COUNTING
NR - DENOTES THAT A COUNTERWEIGHT IS NOT REQUIRED

C24977A

HP Turbine Trim Balancing
Figure 425 (Sheet 1 of 2)



VIEW A
EXAMPLE OF TRIM CODES FB3 FC8 FOR PLANE G



VIEW B
EXAMPLE OF TRIM CODES RB3 RC8 FOR PLANE D

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HP Turbine Trim Balancing
Figure 425 (Sheet 2)

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Installation of Turbine Housing Assembly
Figure 426

(11) Set the controller up as follows:

(a) Switch the main power control "ON".

(b) Make sure controller is set to 490° to 500°F (255°-260°C).

(c) Set timer for 10 minutes.

(d) Push HEATER START button.

(e) Start timer using the START/RESET switch.

WARNING: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(12) When heating time period is over remove heater from first-stage turbine.

(13) Install rod (PWC61065-04) (9) in holding fixture (7).

(14) Install the second stage HP turbine (4) on the first-stage turbine (6) engaging the "X" marked anti-rotation lugs (Ref. Sections A-A and B-B).

(15) Make sure the lines drawn on the inside of the turbines are aligned.

(16) Install pusher (PWC43057) (3), cylinder (PWC89837) (2), and pump (PWC37807) (1).

(17) Pressurize cylinder 1800 to 2000 psi (12411-13789 kPa). Keep pressure up for 5 minutes minimum.

(18) Reduce the pressure in cylinder to zero psi (zero kPa).

(19) Remove pump, cylinder pusher and rod.

21. HP Turbine Module Lifting Adapter Installation

A. HP Turbine Module Lifting Adapter Installation (Ref. Fig. 429)

(1) Attach a suitable lifting sling (16) to three eye bolts (3) on lifting fixture (PWC60623) (2). Attach to overhead crane.

(2) Loosen three nuts (4) and push three pads (5) toward the center of the fixture.

(3) Turn pad assembly (12) up as far as it will go.

(4) Remove second-stage turbine shroud retaining ring (7) from turbine support case (11). Tag ring and identify with engine serial number. Put on build stand.

(5) Set lifting fixture (2) over HP Turbine module.

(6) Remove nut (1) from pusher/holder (PWC60931) (6).

(7) Align split in pusher/holder with "V" the rear of the second-stage turbine. Install pusher holder (6) engaging the two halves on second stage turbine disk (10).

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Installation of Second-stage HP Turbine
Figure 427 (Sheet 1 of 2)

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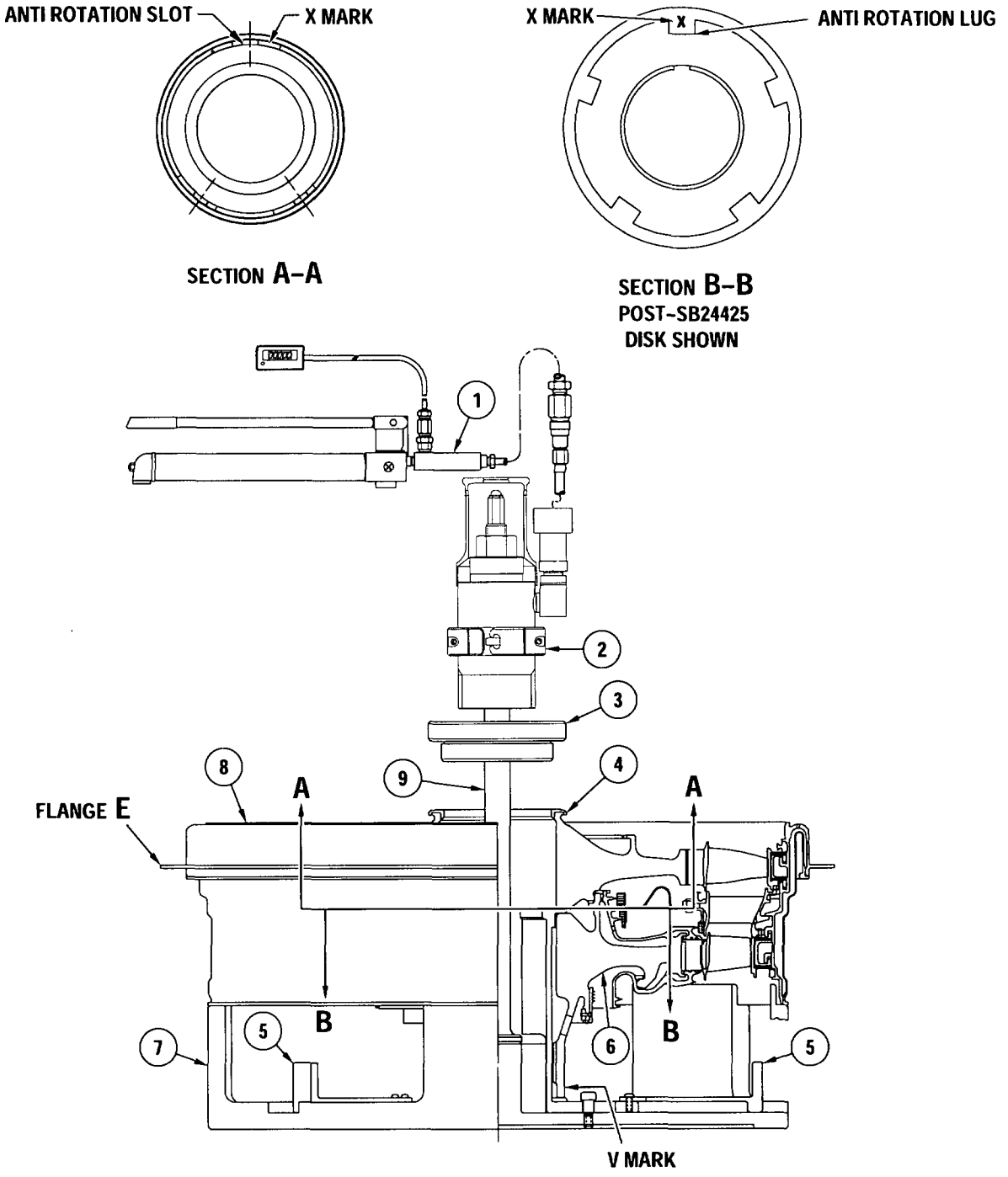
Installation of Second-stage HP Turbine
Figure 427 (Sheet 2)



Assembly of HP Turbine Module
Figure 428

Key to Figure 428

1. Hydraulic Pump
2. Hydraulic Cylinder (PWC89837)
3. Pusher Pad (PWC43057)
4. Second-stage HP Turbine
5. Finger (Part of item 7)
6. First-stage HP Turbine
7. Holding Fixture (PWC43053)
8. HP Turbine Housing Assembly
9. Rod (PWC61065-04)

(8) Lower lifting fixture (2) until it sits on the shoulder of pusher/holder (6).

(9) Align lifting adapter boss (13) with the alignment mark on the holding fixture.

(10) Install nut (1) on pusher/holder (6).

(11) Extend three pads (5) out until they engage in the ring retaining groove in turbine support case (11). Tighten nuts (4).

(12) Turn pad assembly (12) down until it contacts the rear of the second-stage turbine and pads (5) are loaded against the rear of the retaining ring groove. Adjust pads (5) if necessary.

(13) Install lifting adapter (PWC61943) (14) in lifting fixture boss (13). Attach with pin (15).

(14) Remove lifting sling (16).

22. HP Turbine Module Installation

A. HP Turbine Module Installation (Ref. Fig. 430)

(1) Attach overhead crane to lifting adapter (5).

(2) Make sure three pads (4) are engaged in turbine housing and that nuts (1) are tight.

(3) Retract lock (3).

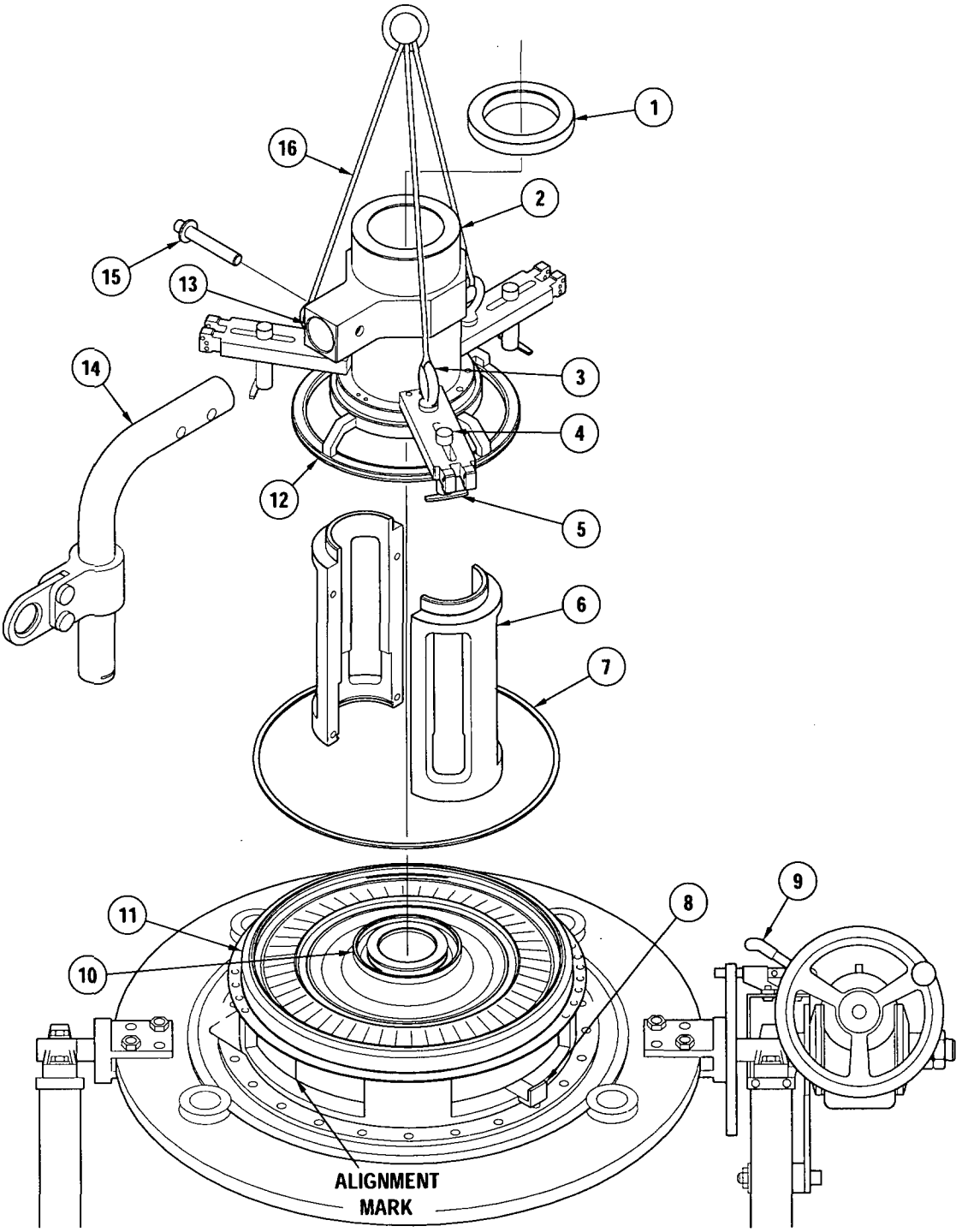
CAUTION: MAKE SURE FINGERS (2) ARE OUT AS FAR AS THEY WILL GO.

(4) Turn build stand 90 degrees so that lifting adapter (5) is on top.

(5) Make sure the first-stage turbine is positioned as follows:

(a) Pre-SB24425: With master spline at 12 O'clock position.

(b) Post-SB24425: With the "V" mark on the front outside spigot diameter at 12 O'clock position.



C75588

Installation of HP Turbine Module Lifting Adapter
Figure 429

Key to Figure 429

1. Nut (Part of item 6)
2. Lifting Fixture (PWC60623)
3. Eye Bolt (Part of item 2)
4. Nut (Part of item 2)
5. Pad (Part of item 2)
6. Holder/Pusher (PWC60931)
7. Shroud Retaining Ring
8. Clamp Finger
9. Lock
10. Second-stage HP Turbine
11. HP Turbine Housing
12. Pad (Part of item 2)
13. Lifting Adapter Boss (Part of item 2)
14. Lifting Adapter (PWC61943)
15. Locking Pin
16. Lifting Sling

(6) Make sure that the "X" marked offset hole in flange E of the turbine housing is at 12 O'clock position.

(7) Clean the contact surface on the first-stage turbine using a clean lint free wiper and alcohol (PWC11-014B).

(8) If necessary turn the engine in the build stand until the compressor shaft is level.

(9) Adjust the overhead crane to hold the weight of the HP turbine module.

(10) If necessary install three turbine holding arms (9) on the lifting fixture.

(11) Push two clamp fingers (2) toward the center of the holding fixture to release the HP turbine module.

(12) Remove the HP module from the holding fixture.

(13) Adjust turbine holding arms (9) into the safety position in front of the first-stage turbine.

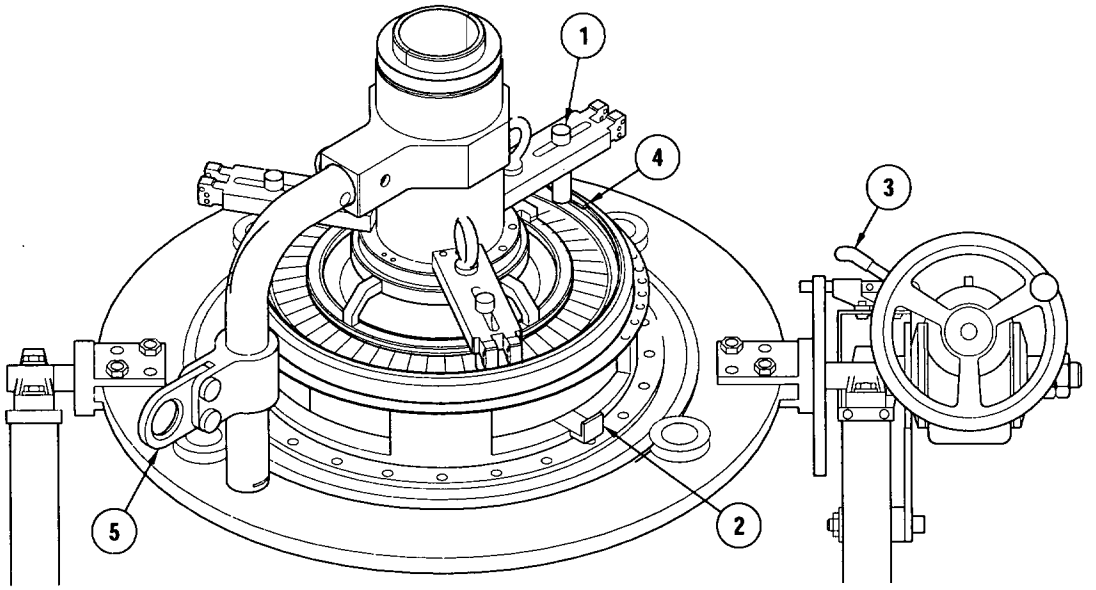
(14) Lift the HP turbine module until the center line of the first-stage turbine is aligned with the center line of the compressor shaft.

(15) Attach heater assembly (PWC60916) to controller (PWC60136).

(16) Clean and dry all mating surfaces.

(17) Install heater in first-stage HP turbine.

(18) Set the controller up as follows:

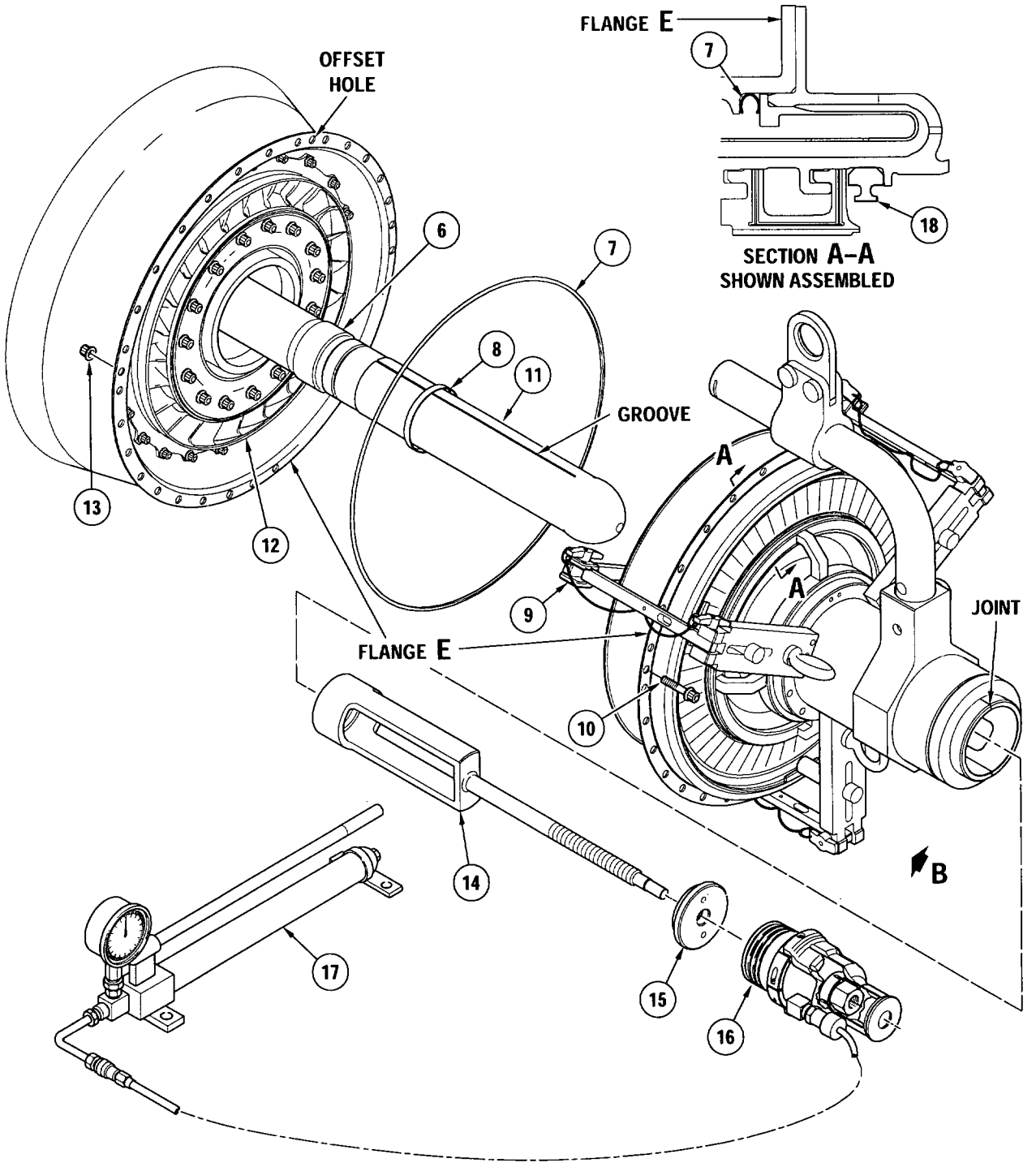


C75688

Installation of HP Turbine Module
Figure 430 (Sheet 1 of 2)

Key to Figure 430

1. Nut
2. Clamp Finger
3. Lock
4. Pad
5. Lifting Adapter
6. Compressor Rotor Stub Shaft
7. Gasket
8. Spacer
9. Safety Arm
10. Bolt (Slave)
11. Stub Shaft Guide (PWC61014)
12. First-stage HP Turbine Vane
13. Nut (Slave)
14. Adapter (PWC60930)
15. Pad (PWC43057)
16. Hydraulic Cylinder (PWC89837)
17. Hydraulic Pump (PWC37807)
18. Shroud Retaining Ring



C75601D

Installation of HP Turbine Module
Figure 430 (Sheet 2)

CAUTION: MAKE SURE THE PRESET TEMPERATURE IS SET FOR 540° TO 560°F (282° - 293°C).

(a) Switch the main power control "ON".

(b) Set timer for 15 minutes.

(c) Push HEATER START button.

(d) Start timer using the START/RESET switch.

(19) Install compressor anti-rotation fixture (PWC60247) on intermediate case. Do not tighten expander nut at this time.

NOTE: This tool cannot be used if the intershaft seal housing is installed.

(20) Set the compressor rotor stub shaft (6) and lock in position with anti-rotation fixture (PWC60247) as follows:

(a) Pre-SB24425: Turn shaft until master spline is at 12 O'clock position.

(b) Post-SB24425: Turn shaft until the scallop in the rear face of the shaft is at 12 O'clock position.

(21) Clean the contact surface on the turbine rotor air seal using a clean lint free wiper and alcohol (PWC11-014B).

(22) Clean the contact surface on the HP turbine spacer (8) using a clean lint free wiper and alcohol (PWC11-014B).

(23) Measure the thickness of HP turbine spacer (8). Make sure it has the necessary thickness (Ref. Para. 15.).

(24) Install HP turbine spacer (8) with "V" mark at 12 O'clock position and the chamfered ID in.

(25) Install gasket (7) in flange E of the combustion chamber outer case (Ref. Section A-A).

(26) Make sure that the seal ring is installed in HP turbine first-stage vane (12) and that the joint is bonded together.

(a) If joint is not bonded together, apply bonding compound.

(27) Lubricate preformed packing and install stub shaft guide (PWC61014) (11) in compressor stub shaft (6) as follows:

(a) Pre-SB24425 With dowel pin in line with master spline.

(b) Post-SB24425: With dowel pin engaged in the scallop in the rear face of the shaft.

(28) Make sure the temperature at the front of the first-stage turbine is above 300°F (149°C) using a thermocouple.

WARNING: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(29) When temperature is above 300°F (149°C) remove heater. Switch power controller to the OFF position.

(30) Adjust turbine holding arms (9) away from the front of the first-stage HP turbine.

(31) Install the HP turbine module using the joint in the holder/pusher and the groove in the top of stub shaft guide (11) to align the parts.

(32) Push the parts together as far as they will go. Make sure that the "X" marked offset holes in flange E are aligned.

(33) Remove stub shaft guide (11).

(34) Insert adapter (PWC60930) (14) through the turbine module and install it on stub shaft (6).

(35) Install pusher pad (PWC43057) (15), hydraulic cylinder (PWC89837) (16), and pump (PWC37807) (17).

(36) Pressurize cylinder 1800 to 2000 psi (12411-13789 kPa). Keep pressure up for 5 minutes minimum.

(37) Install eight slave nuts (10) and bolts (13) equally spaced around flange E. Gradually pull the flange together using an alternating pattern.

CAUTION: SUPPORT SPLIT HOLDER/PUSHER WHEN REMOVING LIFTING FIXTURE.

(38) Remove tooling.

(39) Make sure alignment marks on second-stage turbine and shaft are aligned.

(40) Install second-stage turbine shroud retaining ring (18) in turbine support case (Ref. Section A-A).

(41) Install second-stage HP turbine rear air seal and retaining nut (Ref. Para. 22. and B.).

B. Installation of HP Turbine Retaining Nut (Alternate) (Ref. Fig. 431)

CAUTION: USE SLAVE NUT FOR INITIAL TORQUE ONLY.

(1) Lubricate parts with anti-seize compound (PWC06-009) Ref. (F & C, REF. NO. 1705).

(2) Install nut (3) on compressor rotor stub shaft (4).

(3) Install wrench support (PWC60719) (1) on Flange E of the turbine housing (5). Attach using four slave bolts (7) supplied with the tool.

(4) Connect wrench (PWC41050) (10) to crane and lift it to the height of the wrench support.

(5) Install tooling as follows:

(a) Pre-SB24197: Install adapter (PWC43276), socket (PWC43275), wrench (PWC41050), drive bar (PWC43515) and wrench adapter (PWC32550) or (PWC41150).

(b) Post-SB24197: Install , socket (PWC60234) adapter (PWC60331) and wrench (PWC41050).

(6) Torque HP turbine retaining nut Ref. (F&C, REF. NO. 1705).

(7) Release torque on wrench (PWC41050) and remove all tools.

CAUTION: TURBINE MUST BE LOADED FORWARD.

(8) Measure run-out on second-stage HP turbine disk at location B. Maximum run-out is 0.0025 inch, FIR. If run-out exceeds 0.0025 inch, remove turbines (Ref. Para. 5.). Clean and inspect parts then reinstall.

(9) Install keywasher (2) and retaining ring (1) (Pre-SB24197) or stake keywasher (8), (Post-SB24197) in six locations, using crimper (PWC60242).

C. Dummy HP Turbine nut Procedure

(1) Secure second-stage HP turbine as follows:

CAUTION: LUBRICATE THREADS AND THRUST FACE OF NUT, SHAFT AND REAR AIR SEAL AS WELL AS CUP WASHER (PRE-SB24197) WITH ANTI-SIEZE COMPOUND (PWC06-009) PRIOR TO EACH TIGHTENING.

(a) Lubricate nut (Pre-SB24197), or cup washer and nut (Post-SB24197) and install on compressor rotor stub shaft.

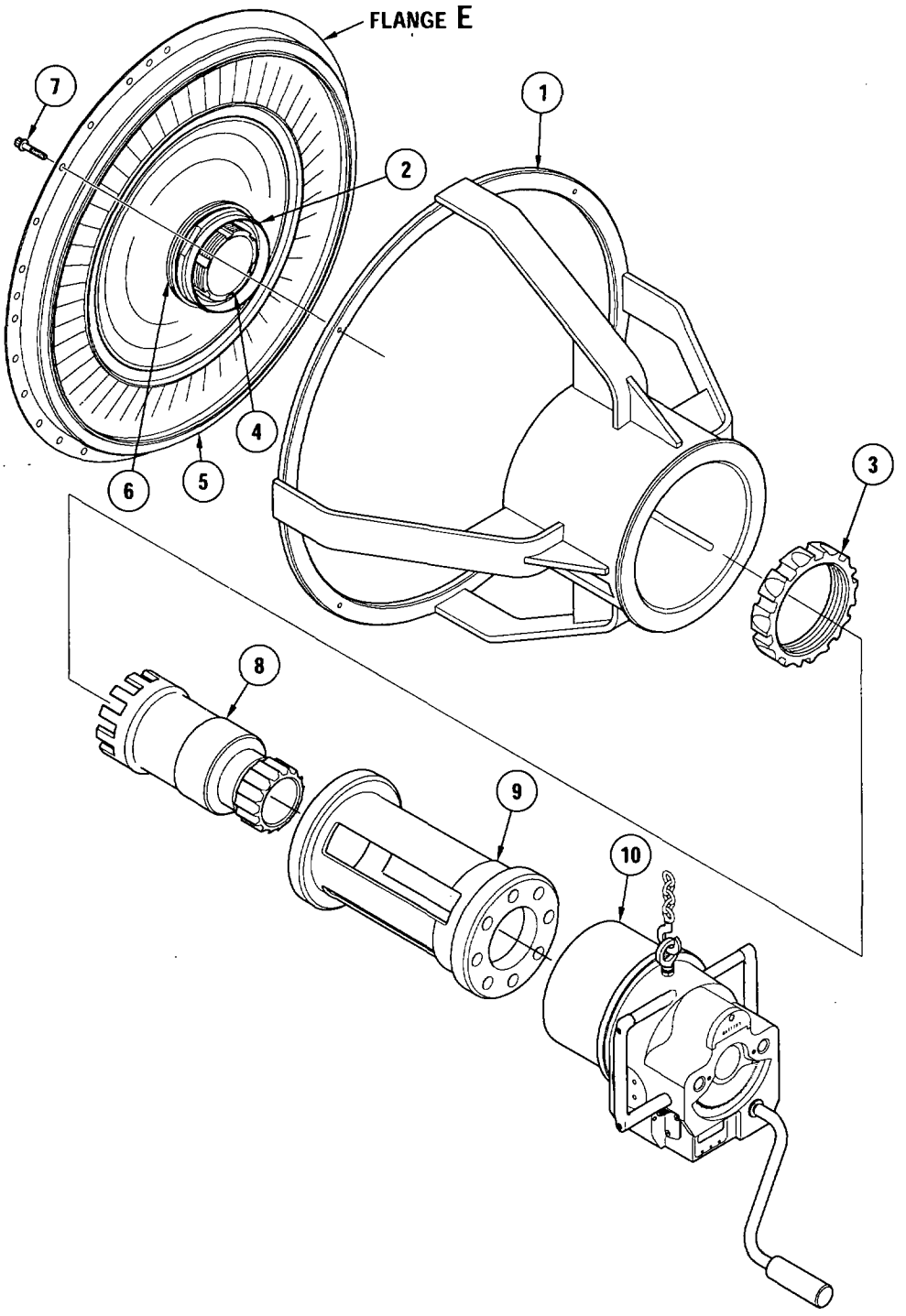
(b) Install support (PWC43284) (Pre-SB24197) or (PWC60719) (Post-SB24197) on flange E using three slave bolts.

(c) Install socket (PWC43275) and adapter (PWC43276) (Pre-SB24197) or socket (PWC60234) and adapter (PWC60331) (Post-SB24197).

(d) Install adapter (PWC32550) or (PWC41150), drive bar (PWC43515-11) and wrench (PWC41050).

(e) Tighten nut 840 to 960 lb. in. (95-108 Nm.).

(f) Establish common reference points between nut and shaft.



Post-SB24179 Installation Shown C75802

Installation of HP Turbine Retaining Nut
Figure 431

Key to Figure 431

1. Wrench Support (PWC60719)
2. Key Washer Post-SB24197
3. Nut Post-SB24197
4. Stub Shaft
5. Turbine Housing Assembly
6. Rear Air Seal
7. Bolt (0.250-28UNF X 0.625)
8. Socket (PWC60234)
9. Adapter (PWC60331)
10. Wrench (PWC41050)

(g) Turn nut through further angle of 58 to 60 degrees.

(h) Loosen nut to 0.0 lb.in. (0.0 Nm).

CAUTION: LUBRICATE THREADS AND THRUST FACES OF NUT, SHAFT AND REAR AIR SEAL AS WELL AS CUP WASHER (PRE-SB24197) WITH ANTI-SIEZE COMPOUND (PWC06-009) PRIOR TO EACH TIGHTENING.

(i) Tighten nut 840 to 960 lb. in. (95-108 Nm.).

(j) If the reference point on the nut is in line with the shaft reference point or beyond it within 3.5 degrees max. Turn nut through further angle of 58 to 60 degrees.

(k) If the reference points are not within limits, repeat steps (f) through (j) until results are satisfactory.

HP TURBINES - INSPECTION/CHECK

1. General

   A. This section provides instructions and limits for inspection/check of the HP turbines and related parts.

      NOTE: The procedures described in this section can only be done during Heavy Maintenance.

   B. It is recommended that a magnifying glass of at least 10X power be used when visually inspecting for damage.

   C. Within the following text, where the term nicks or dents is used, unless otherwise specified, blend repair limits are applicable provided at least 70 percent of original surface remains undamaged.

   D. Parts found unsuitable for further engine running should be replaced. Rejected parts should be returned to Pratt & Whitney Canada for complete inspection and possible repair/refurbishment.

   E. Cleaning and Inspection of the P2.5 and P2.8 BOV's must be performed at the same time as the HP Turbine Inspection/Check. Reference:

      - Chapter 05-20-00 - Scheduled Maintenance Checks.
      - Chapter 75-30-01 - Compressor Bleed Valves - Maintenance Practices.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC06-009	Compound, Antisieze

3. Special Tools

   Not Applicable

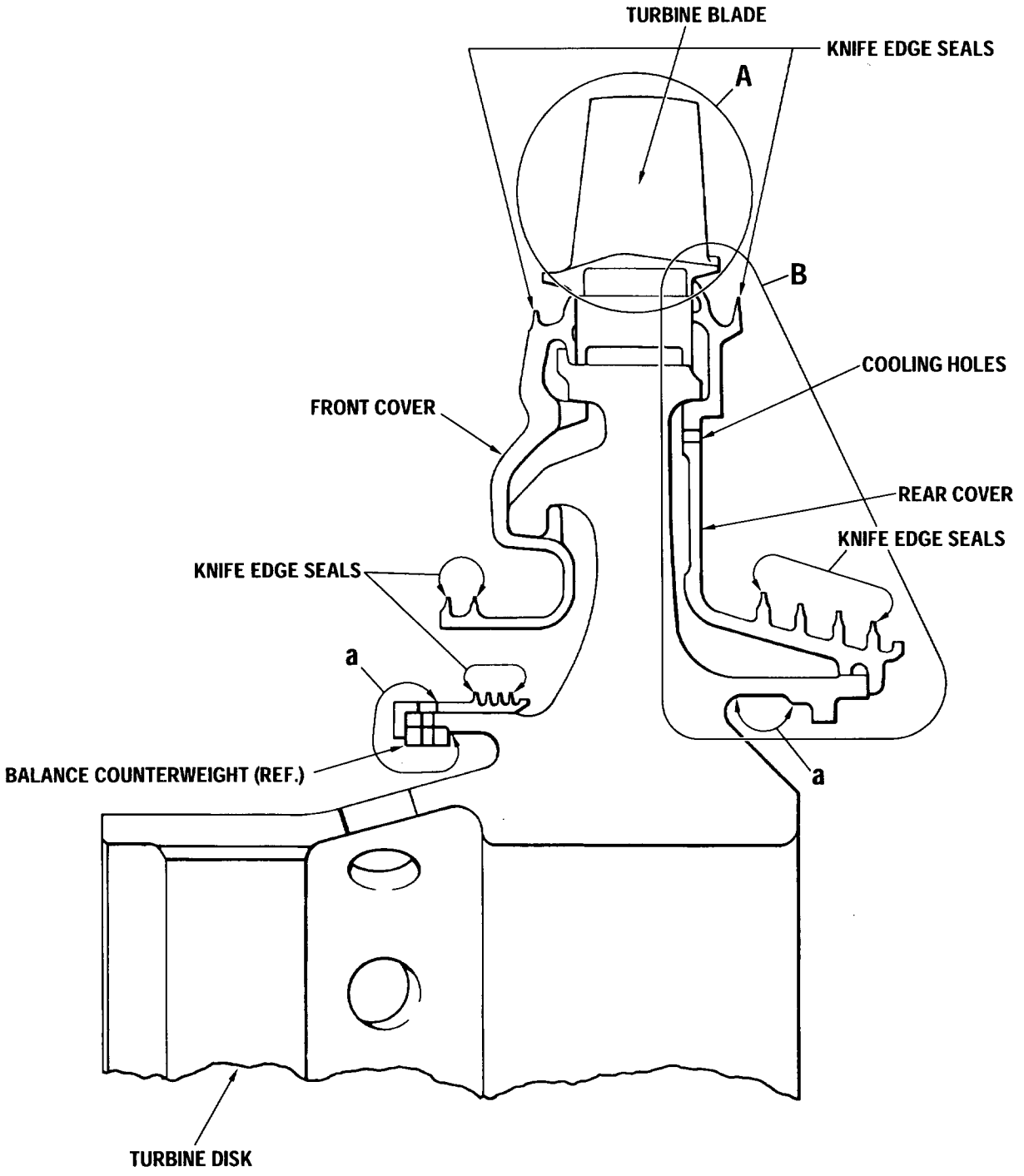
4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. First-stage HP Turbine Disk Assembly (Ref. Fig. 601)

   NOTE: 1. First and second-stage turbine disk assemblies comprise a balanced assembly. Rejection of either disk assembly requires that both be returned to a repair and overhaul facility capable of turbine balancing.

   NOTE: 2. If turbine blades are removed from the disk for any reason, inspection of those area not covered below, should be performed per the visual inspection criteria in the PW300 CIR Manual.



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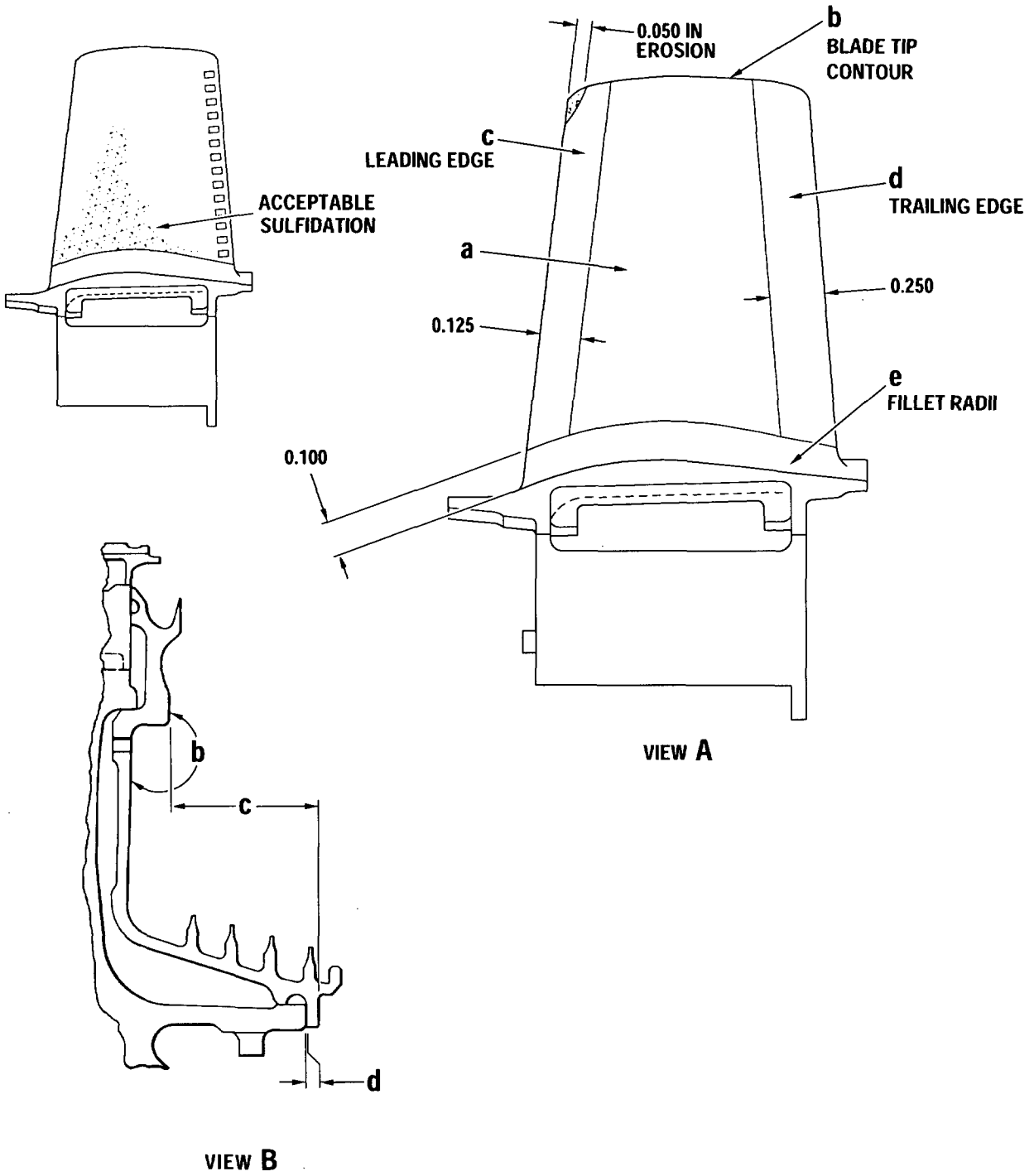
First-stage HP Turbine Disk Assembly
Figure 601 (Sheet 1 of 3)



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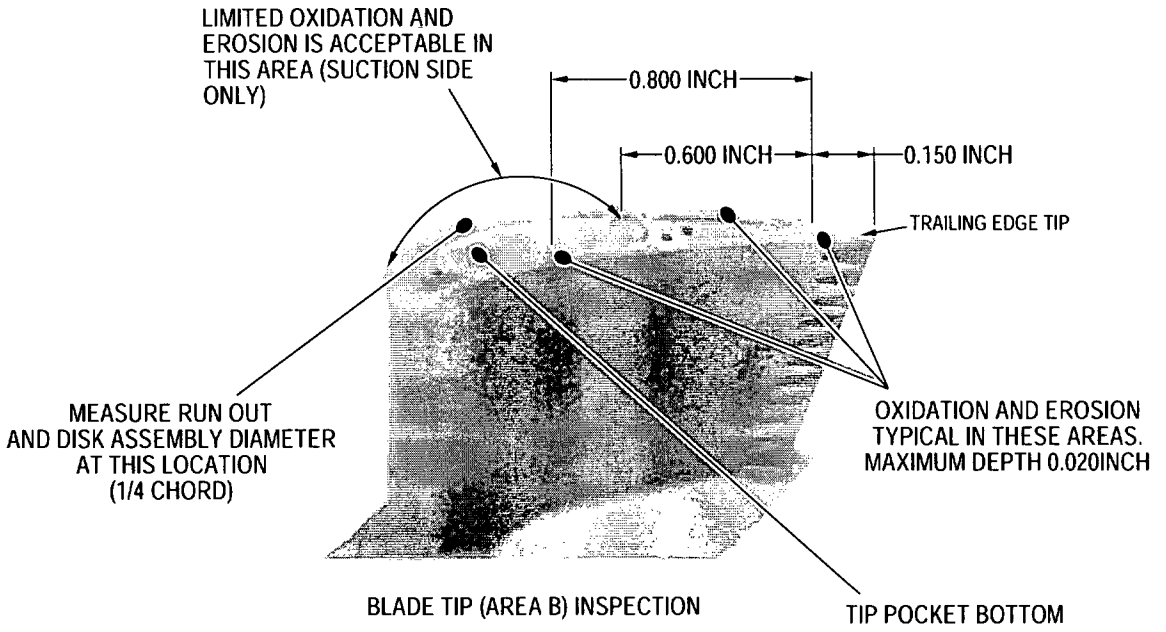
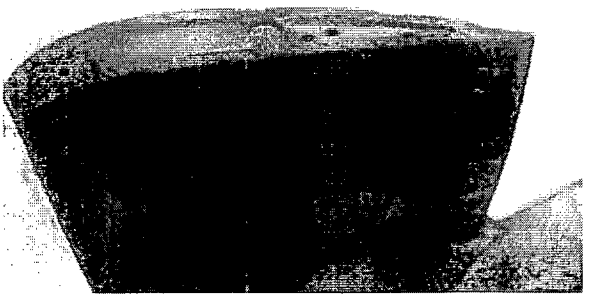
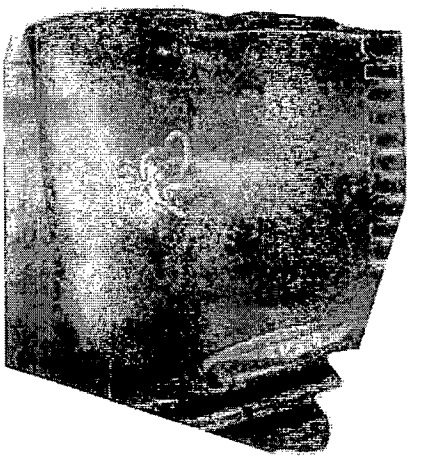
First-stage HP Turbine Disk Assembly
Figure 601 (Sheet 2)

ORIGINAL
As Received By
ATP


LIMITED OXIDATION AND EROSION IS ACCEPTABLE IN THIS AREA (SUCTION SIDE ONLY)
0.800 INCH
0.600 INCH
0.150 INCH
TRAILING EDGE TIP
MEASURE RUN OUT AND DISK ASSEMBLY DIAMETER AT THIS LOCATION (1/4 CHORD)
OXIDATION AND EROSION TYPICAL IN THESE AREAS. MAXIMUM DEPTH 0.020INCH
BLADE TIP (AREA B) INSPECTION
TIP POCKET BOTTOM



ACCEPTABLE BLADE TIP CONDITION



UNACCEPTABLE BLADE TIP CONDITION

C152223

First-stage HP Turbine Disk Assembly
Figure 601 (Sheet 3)

A. Visual Check of Turbine Disk

(1) Inspect for cracks. No cracks permitted, reject assembly if evident.

(2) Inspect for nicks, dents, scratches or scores. Reject if evident.

(3) Inspect for security of balance counterweights retaining rivets. Replace as necessary.

(4) Inspect for signs of hot gas ingestion or overtemperature at the apex of fir-tree fixings. White color indicates overtemperature. Return HP turbine disk assembly to overhaul facility if evident.

B. Visual Check of Front and Rear HP Turbine Covers

(1) Inspect for cracks. No cracks permitted, reject assembly if evident.

(2) Inspect for rear cover deformation. Reject if Dim. c is less than 1.035 inch (26.29 mm) and Dim. d in excess of 0.005 inch (0.13 mm) (Ref. View B).

(3) Nicks, dents, scratches or scores. Reject if evident.

(4) Inspect for damaged knife edge seals. Reject if evident.

NOTE: Any amount of coating loss is acceptable.

(5) Inspect for damaged cooling holes. No damage is permitted, reject assembly if damage is evident.

(6) Inspect for blocked cooling holes. Clear as necessary.

C. Visual Check of Turbine Blades

(1) Check area a (airfoil surface) for:

(a) Pitting. Pitting is acceptable up to a maximum depth of 0.010 inch provided it is not more than 30 percent of the total surface.

(b) Nicks or dents. Nicks or dents to a maximum depth of 0.015 inch is acceptable provided there is not more than six per square inch and are separated by a minimum of 0.100 inch.

(c) Raised metal and sharp edges. Stone to remove.

(d) Coating erosion exposing base metal over less than 40% of the pressure (concave) surface is acceptable. Localized sulfidation attack like blisters are acceptable provided the blisters do not burst.

(2) Check area b (blade tip contour) for:

(a) Radial cracks are acceptable provided:

1 Cracks are not located within 0.400 inch from the trailing edge.

2 Individual cracks are acceptable up to a maximum of 0.100 inch long.

3 Converging cracks are acceptable provided they are a minimum of 0.100 inch apart.

4 Non-converging cracks are acceptable provided they are a minimum of 0.025 inch apart.

(b) Erosion at leading edge tip corner. Erosion is acceptable to a maximum of 0.050 inch deep provided the wall thickness is not less than 0.010 inch.

(c) Oxidation, erosion or rub at trailing edge tip corner is acceptable provided there is no deformation or cracks and material loss is not more than 0.030 inch deep and 0.250 inch long.

(d) Oxidation, erosion, rub and material loss over approximately 0.6 inch of suction face and 0.8 inch of pressure face tip contour (Ref. Fig. 601) is acceptable provided it does not go below the tip pocket bottom. Local oxidation with material loss of 0.015 inch deep is acceptable.

(e) Raised metal and sharp edges. Stone to remove.

(3) Check area c (leading edge) for:

(a) Hairline cracks are acceptable up to a maximum of 0.100 inch long, provided the cracks are located above 50 percent of the total height of the blade, measured from the bottom of the firtree root fixing.

(b) Pitting. Pitting is acceptable up to a maximum depth of 0.020 inch provided it is not more than 30 percent of the total surface.

(c) Erosion:

1 Erosion confined to the coating layer is acceptable.

2 Erosion exposing the base material is acceptable over less than 40% of the surface.

(d) Nicks or dents. Nicks or dents to a maximum depth of 0.020 inch is acceptable provided there is not more than five and are separated by a minimum of 0.100 inch.

(e) Raised metal and sharp edges. Stone to remove.

(4) Check area d (trailing edge) for:

(a) Pitting. Pitting is acceptable up to a maximum depth of 0.010 inch provided it is not more than 30 percent of the total surface.

(b) Nicks or dents. Nicks or dents to a maximum depth of 0.010 inch is acceptable provided there is not more than four and are separated by a minimum of 0.100 inch.

(c) Raised metal and sharp edges. Stone to remove.

(5) Check areas e (fillet radii) for:

(a) Pitting. Pitting is acceptable up to a maximum depth of 0.010 inch provided it is not more than 30 percent of the total surface.

(b) Nicks or dents. Nicks or dents to a maximum depth of 0.010 inch is acceptable provided there is not more than four and are separated by a minimum of 0.100 inch.

(c) Coating erosion exposing base metal over less than 40% of the surface is acceptable.

(d) Raised metal and sharp edges. Stone to remove.

(6) Check blade platform for:

(a) Crack indications on the gas path side of the blade platform are acceptable provided:

1 Any two converging indications are not open through the total thickness of the blade platform.

2 Indications extending into the blade airfoil are acceptable up to a maximum of 0.075 inch in height, measured from the blade platform top surface.

(b) Pitting. Pitting is acceptable up to a maximum depth of 0.008 inch provided it is not more than 30 percent of the total surface.

(c) Wear of the platform faces is acceptable up 0.005 inch deep provided the platform edge thickness is a minimum of 0.025 inch.

(d) Nicks or dents. Nicks or dents to a maximum depth of 0.010 inch is acceptable provided it is not more than 20 percent of the total surface.

(e) Coating erosion exposing base metal over less than 40% of the surface is acceptable.

(f) Raised metal and sharp edges. Stone to remove.

(7) Inspect for blocked cooling holes. Clear as necessary.

6. Second-stage HP Turbine Disk Assembly (Ref. Fig. 602)

NOTE: First and second-stage turbine disk assemblies comprise a balanced assembly. Rejection of either disk assembly requires that both be returned to an overhaul facility to be rebalanced.

A. Turbine Disk Assembly Inspection

(1) Inspect for security of balance counterweights retaining rivets. Replace as necessary.

(2) Inspect bore of disk for recent (surface not oxidized) scores, nicks and dents. If unoxidized scores, nicks and dents are found, return disk to an overhaul facility for a full inspection.

(3) Visual Check of Turbine Blades (Ref. Fig. 602).

(a) Check area a (airfoil surface) for:

1 Pitting. Pitting is acceptable up to a maximum depth of 0.010 inch.

NOTE: Total cumulative pitting of blade airfoil surfaces not to exceed 30 percent.

2 Nicks or dents. Nicks or dents to a maximum depth of 0.015 inch is acceptable provided there is not more than six per square inch and are separated by a minimum of 0.100 inch.

3 Erosion confined to the coating layer is acceptable. Erosion exposing the base metal over less than 40% of the pressure (concave) face is acceptable.

4 Raised metal and sharp edges. Stone to remove.

5 Hairline cracks that initiate from radius m, at the botom of the pocket and extend down are acceptable up to a maximum of 0.100 inch in length.

(b) Check area b (blade tip contour) for:

1 Erosion at leading edge tip corner. Erosion is acceptable and may be blended up to a maximum radius of 0.050 inch.

2 Radial cracks. Cracks are acceptable up to a maximum length of 0.100 inch provided they do not initiate within 0.400 inch from the trailing edge.

NOTE: Converging cracks must be separated by a minimum of 0.100 inch and non-converging cracks must be separated by a minimum of 0.025 inch.

3 Oxidation, rub and surface damage across tip contour is acceptable provided it is within 0.020 inch from the tip.

4 Raised metal and sharp edges. Stone to remove.

(c) Check area c (leading edge) for:

1 Pitting. Pitting is acceptable up to a maximum depth of 0.020 inch.

NOTE: Total cumulative pitting of leading edge surface not to exceed 30 percent.

2 Erosion confined to coating layer without exposing the base material is acceptable.

3 Erosion exposing the base material is acceptable up to a maximum depth of 0.005 inch.

4 Nicks or dents. Nicks or dents to a maximum depth of 0.020 inch is acceptable provided there is not more than five and are separated by a minimum of 0.100 inch.

5 Raised metal and sharp edges. Stone to remove.

(d) Check area d (trailing edge) for:

1 Pitting. Pitting is acceptable up to a maximum depth of 0.010 inch.

NOTE: Total cumulative pitting of trailing edge surface not to exceed 30 percent.

2 Erosion. Erosion is acceptable provided no base metal is exposed.

3 Nicks or dents. Nicks or dents to a maximum depth of 0.010 inch is acceptable provided there is not more than four and are separated by a minimum of 0.100 inch.

4 Raised metal and sharp edges. Stone to remove.

(e) Check areas e (fillet radii) for:

1 Pitting. Pitting is acceptable up to a maximum depth of 0.010 inch.

NOTE: Total cumulative pitting of fillet radii surface not to exceed 30 percent.

2 Nicks or dents. Nicks or dents to a maximum depth of 0.010 inch is acceptable provided there is not more than four and are separated by a minimum of 0.100 inch.

3 Erosion confined to the coating layer is acceptable. Erosion exposing the base metal over less than 40% of the pressure (concave) face is acceptable.

4 Raised metal and sharp edges. Stone to remove.

(f) Check blade platform for:

1 Hairline cracks (gas path side). Acceptable up to a maximum of 0.003 inch deep provided:

a There is no evidence of base metal cracks.

b Cracks are non-converging.

c Cracks do not extend into the airfoil radii.

2 Pitting. Pitting is acceptable up to a maximum depth of 0.008 inch.

NOTE: Total cumulative pitting of blade platform surface not to exceed 30 percent.

3 Nicks or dents. Nicks or dents to a maximum depth of 0.010 inch is acceptable provided there is not more than 20 percent of the surface damaged.

NOTE: Damage must not extend into the airfoil fillet radii.

4 Erosion confined to the coating layer is acceptable. Erosion exposing the base metal over less than 40% of the pressure (concave) face is acceptable.

5 Raised metal and sharp edges. Stone to remove.

(g) Inspect trailing edge/airfoil root (Area g) for:

1 Damage. No damage allowed.

NOTE: Area g extends 0.150 in. (3.81 mm) from platform Surface and 0.150 in. (3.81 mm) from trailing edge.

(h) Erosion of coating without exposing base metal is acceptable.

(4) Inspect for blade shift. Reject assembly if blade root protrusion in excess of 0.010 inch (0.25 mm) either side of disk, when measured normal to disk.

7. HPT Shroud Housing Assembly (Ref. Fig. 603)

A. Visually Check HP Turbine Baffle (Ref. Fig. 604)

(1) Inspect for cracks. Total of three cracks acceptable to a maximum length of 0.200 inch (5.0 mm) provided cracks are separated by a minimum of 0.300 inch (7.6 mm) and are non-converging.

NOTE: No cracks permitted in Areas a.

(2) Inspect for nicks. Any number acceptable to a maximum depth of 0.008 inch (0.20 mm) provided damage is removed by blending to a maximum depth of 0.010 inch (0.25 mm).

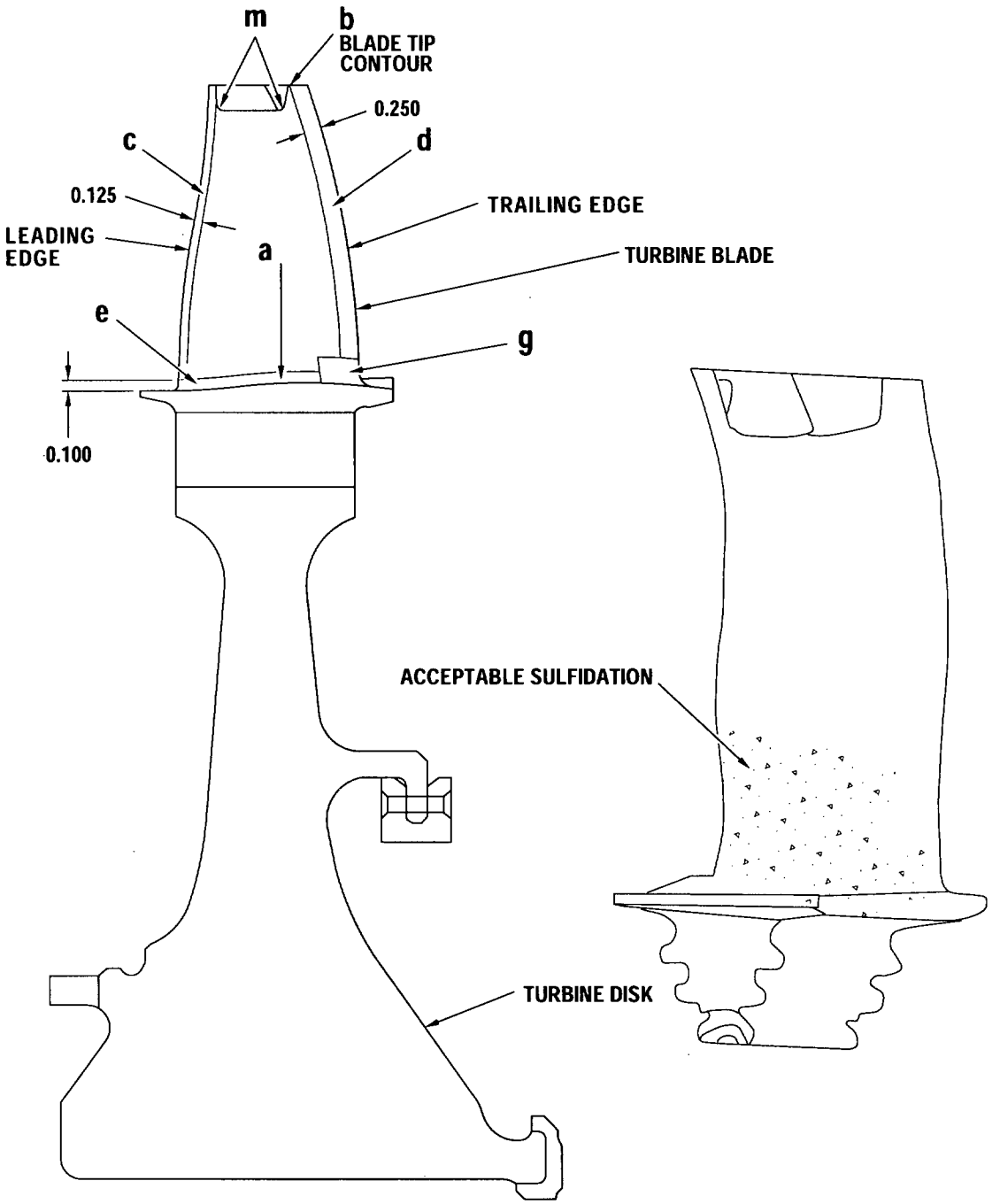
(3) Inspect for dents. Acceptable to a maximum depth of 0.010 inch (0.25 mm).

(4) Fretting and scoring in area a is permitted provided the F&C No. 1219 and 1222 are within limits. Stone to remove raised material.

(5) Inspect for blocked cooling holes. Clear as necessary.

B. Visual Check of HP Turbine Housing (Ref. Fig. 605)

(1) Inspect for cracks. No cracks permitted, reject if evident.



C70177B

Second-stage HP Turbine Disk Assembly
Figure 602

(2) Inspect for nicks or dents. Acceptable to a maximum depth of 0.005 inch (0.13 mm), provided damage is removed by blending to a maximum depth of 0.007 inch (0.17 mm).

(3) Inspect for wear or fretting of Dia. A, Dia. B and or Dia. C. Acceptable to a maximum depth of 0.002 inch (0.05 mm).

(4) Inspect for blocked cooling holes. Clear as necessary.

C. Visual Check of First and Second-stage HP Turbine Shroud Segments

(1) Refer to Para. 17. and 18..

D. Visual Check of First and Second-stage Shroud Retaining Rings

(1) Inspect for cracks, distortion or fretting. Reject if evident.

8. First and Second-stage Stator Seal Rings

A. Visual Checks

(1) Check for cracks and distortion. Reject if evident.

(2) Examine for radial clearance when installed in HPT housing with the gap at the top as follows:

(a) Check that the gap between components does not exceed 0.001 inch (0.03 mm) over an arc of 180 degrees or does not exceed 0.002 inch (0.05 mm) over an arc of 120 degrees or does not exceed 0.003 inch (0.08 mm) over an arc of 60 degrees.

(b) If necessary, rotate seal ring until clearance is within limits.

(c) Note position of seal ring gap.

(d) Reject seal ring if clearance is not within limits.

(3) Examine for evidence of damage, fretting or wear on faces. Acceptable to a maximum depth of 0.005 inch (0.127 mm). Stone to remove sharp edges and raised material.

9. Turbine Vane Retaining Plate (Ref. Fig. 606)

A. Visual Checks

(1) Check all surfaces for raised metal and sharp edges. Stone to remove.

(2) Inspect for cracks. Radial cracks in the area indicated are allowed.

(3) Inspect for nicks or dents. Any number acceptable to a depth of 0.007 inch (0.18 mm) if damage is removed by blending to a maximum depth of 0.010 inch (0.25 mm).

(4) Burning and erosion with material missing in area indicated is acceptable up to a maximum of 3 inches in length at a maximum of 4 locations. Make sure that dimension m is maintained if burning and erosion is present.

(5) Fretting or wear on Faces A and C and diameter B (Post-SB24516) is acceptable. Stone to remove raised material. Dimension m must be maintained.

(6) Dimension m:

(a) Pre-SB24174: 0.192 to 0.194 inch.

(b) Post-SB24174, Pre-SB24354: 0.209 to 0.211 inch.

(c) Post-SB24354: 0.207 to 0.211 inch.

(d) Post-SB24516: 0.277 to 0.281 inch.

10. First-stage HP Turbine Vane Assembly (Pre-SB24174)

A. Visual Check of Inner and Outer First-stage Vane Shrouds

(1) Inspect for cracks. No cracks permitted, reject if evident.

(2) Inspect for nicks or dents. Acceptable to a maximum depth of 0.003 inch (0.08 mm) provided damage is removed by blending to a maximum depth of 0.005 inch (0.13 mm).

B. Visual Check of Vane Retaining Plate

(1) Refer to Para. 9..

C. Visual Check of First-stage Stator Air Seal

(1) Inspect for cracks. Reject if evident.

(2) Inspect for honeycomb cell unbonded of diameters A, B and/or C. Reject if more than 20 adjacent cells unbonded.

D. Visual Check of First-stage Vane Seal Ring

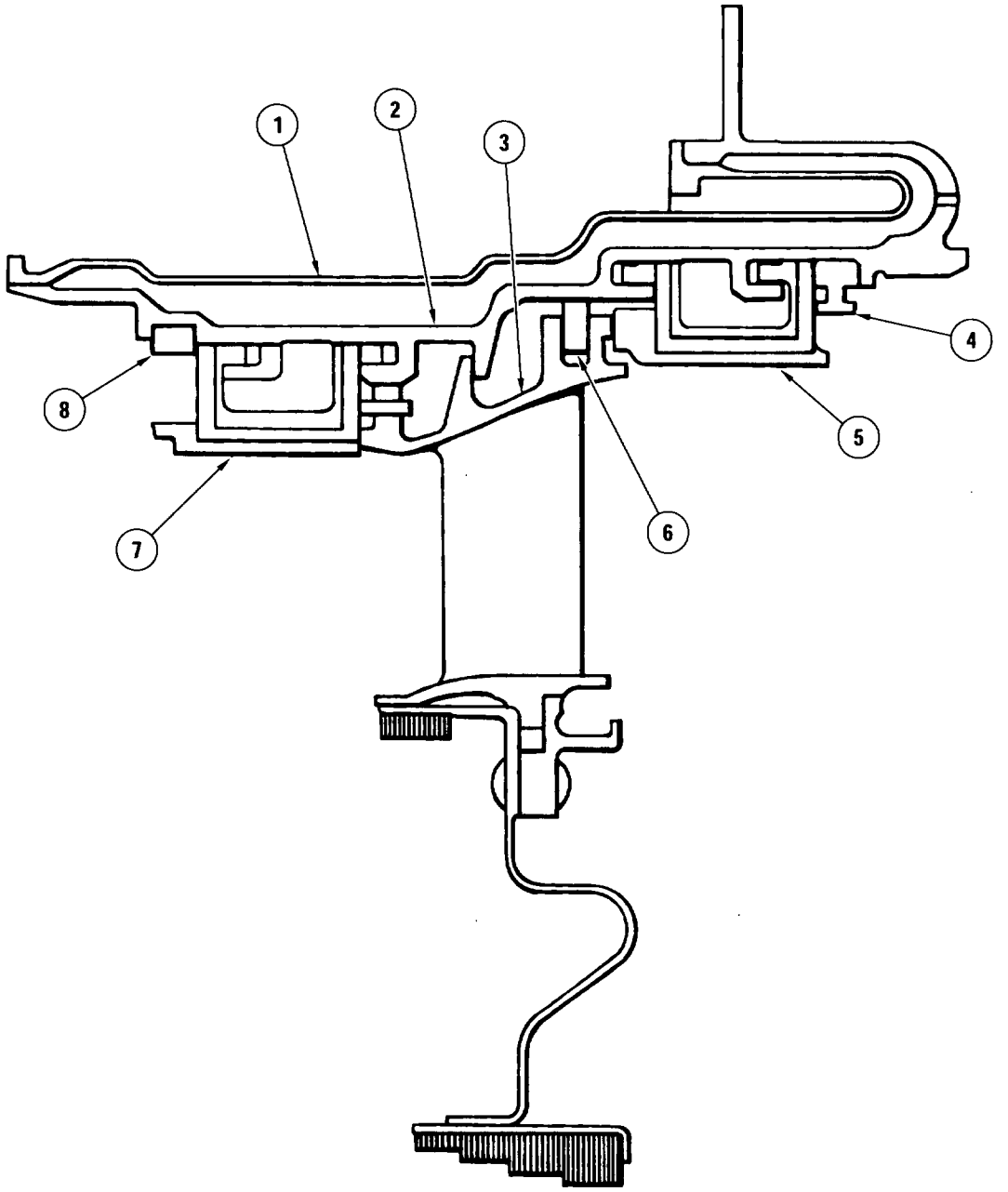
(1) Inspect for cracks or distortion. Reject if evident.

(2) Inspect for radial clearance when installed in HP turbine housing. Gap between components not to exceed 0.001 inch (0.02 mm) (Ref. Assembly).

(3) Inspect for evidence of damage, fretting or wear on faces. Acceptable to a maximum depth of 0.002 inch (0.05 mm).

11. HP Turbine Vane Ring Segments (Ref. Fig. 608)

NOTE: Post-SB24174 Triple vane segments are illustrated. Limits shown also apply to Pre-SB24174 single segment vanes.



C18862

HPT Shroud Housing Assembly and Second-stage Vane Ring
Figure 603

Key to Figure 603

1. HP Turbine Baffle
2. HP Turbine Housing
3. Second-stage Turbine Vane Ring Assembly
4. Second-stage Shroud Retaining Ring
5. Second-stage HP Turbine Shroud Segment
6. Second-stage Stator Seal Ring
7. First-stage HP Turbine Shroud Segment
8. First-stage Shroud Retaining Ring

A. Visual Checks

(1) Airfoils

(a) Leading Edge

1 Cracks between cooling holes are permitted, if the cracks do not form a circular pattern.

2 Erosion is acceptable if base material is not damaged or exposed. Erosion with coating loss less than 0.005 inch (0.127 mm) deep around cooling holes is acceptable.

3 Airfoil surfaces

- Non-converging cracks that may be associated with erosion less than 0.020 inch (0.508 mm) wide are acceptable.
- Multi-pronged cracks covering an area less than 0.300 inch (7.62 mm) diameter are acceptable.

4 Local damage due to nicks, dents or pitting is acceptable up to 0.005 in. (0.127 mm) deep and 0.100 in. (2.540 mm) in diameter.

5 Reject segment if burnt or missing material is found except as indicated.

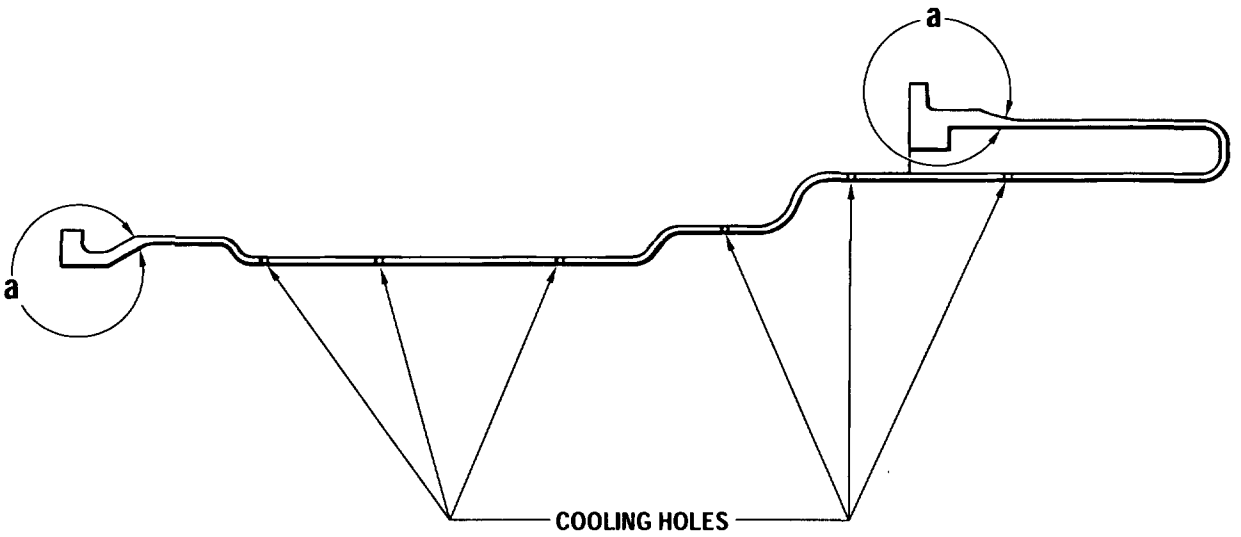
(b) Trailing Edge

1 Non-converging hairline cracks are permitted, including cracks which pass through the cooling holes, if it is not more than the following limits:

a 0.600 in. (15.24 mm) long if cracks are in line on both sides of airfoil, up to a maximum of 1 pair.

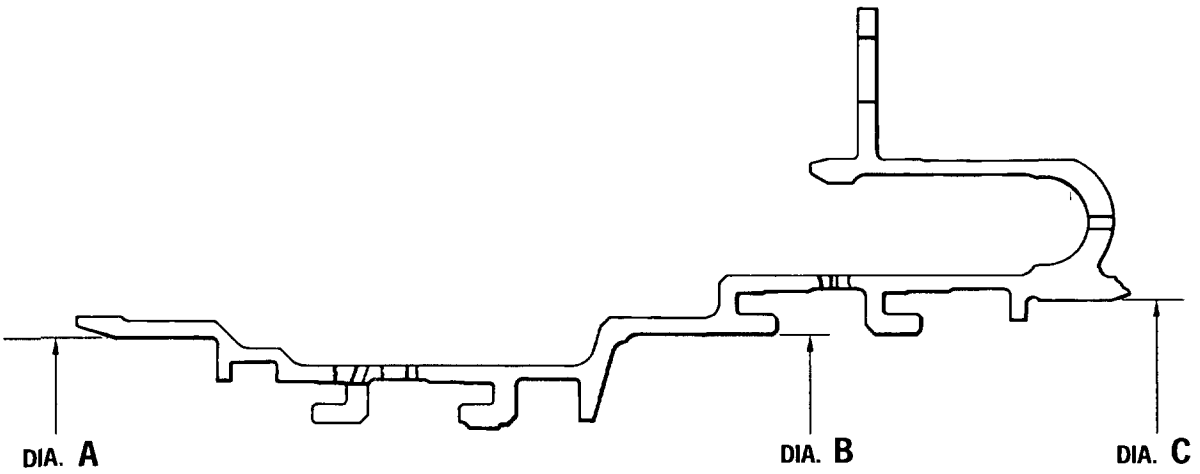
b 1.00 in. (25.40 mm) long if cracks on one side of airfoil are not in line with cracks on opposite side of airfoil.

NOTE: Hairline cracks are repairable.



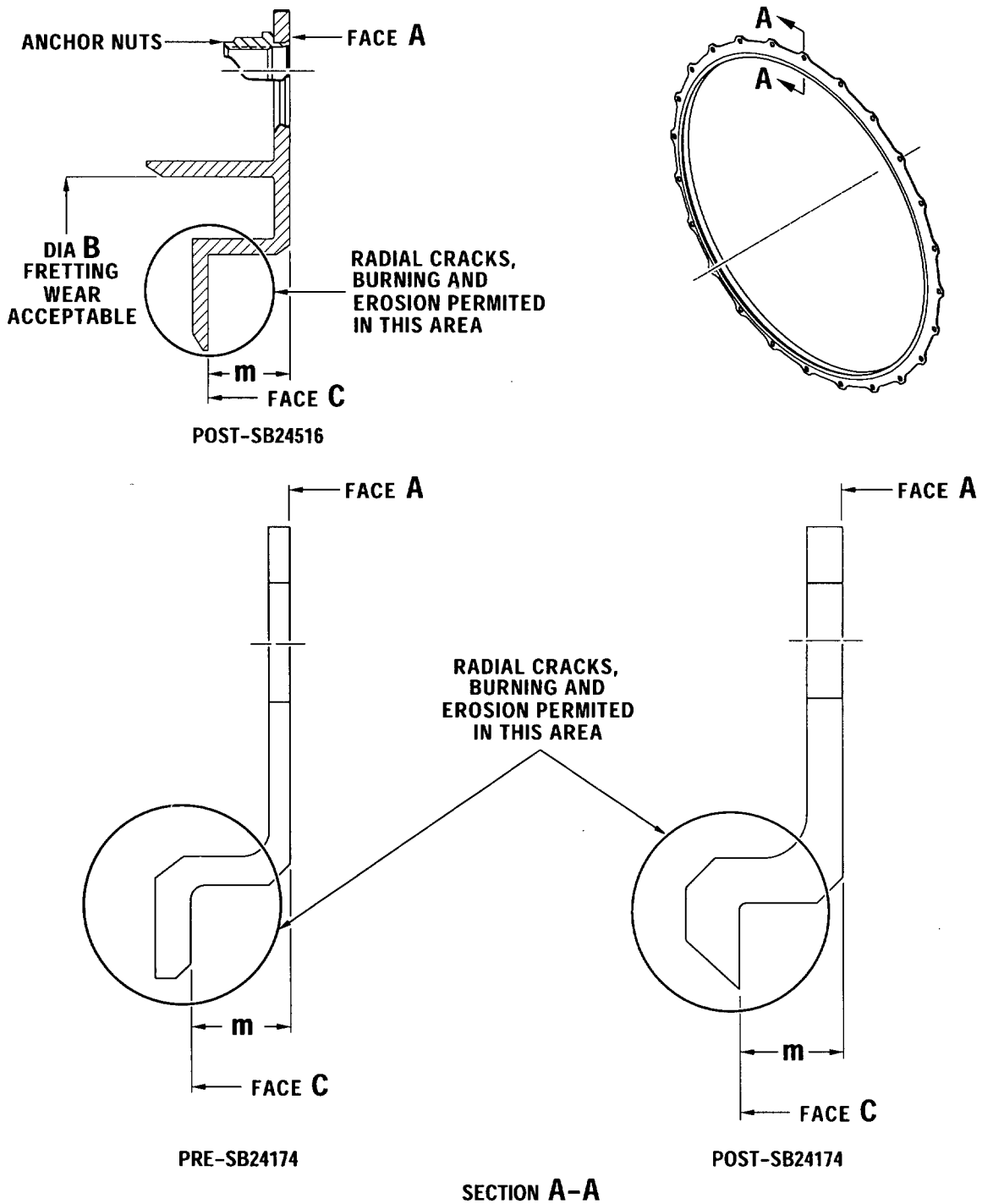
C18857

HP Turbine Baffle
Figure 604

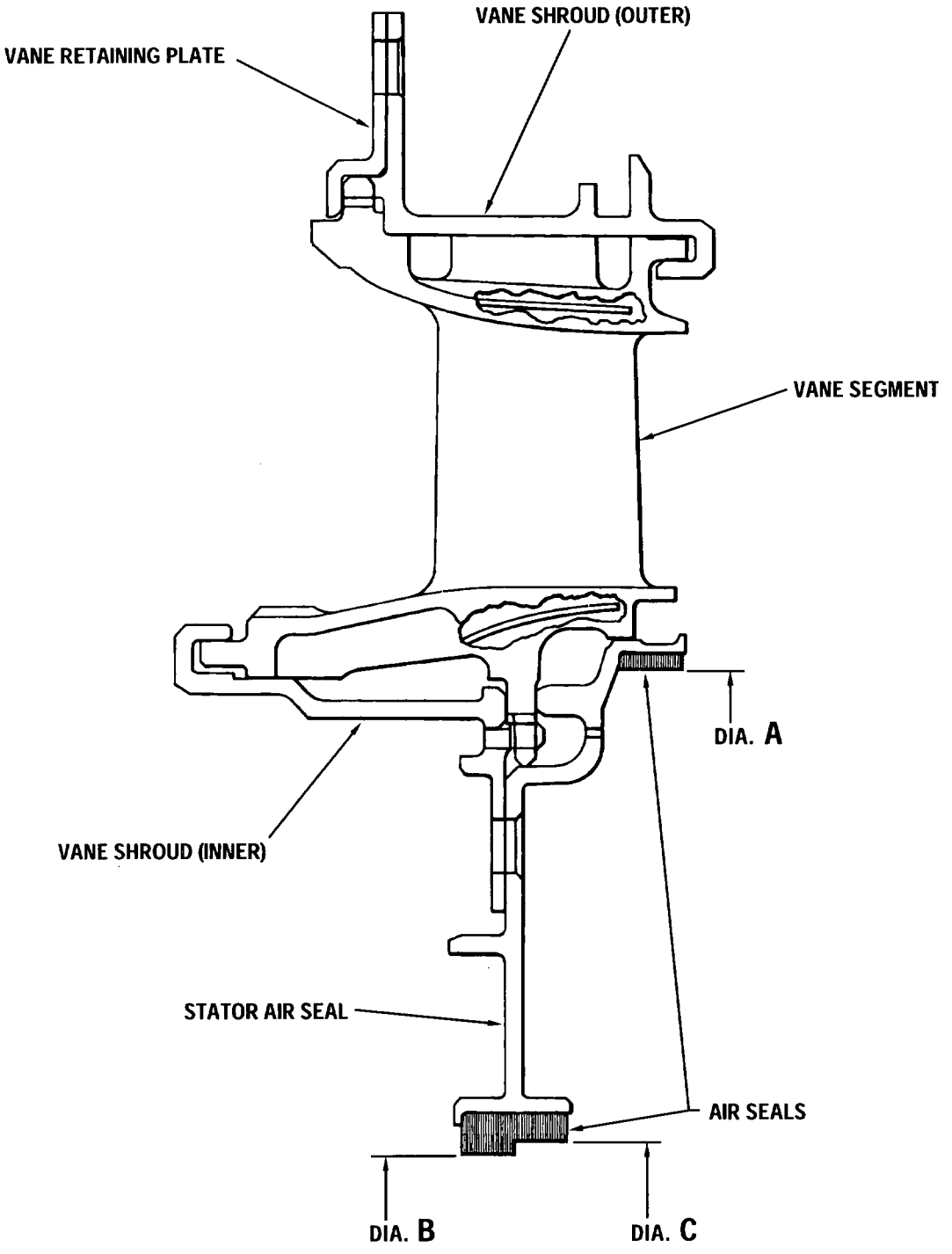


C18856

HP Turbine Housing
Figure 605



Turbine Vane Retaining Plate
Figure 606



C18859

First-stage HP Turbine Vane Assembly
Figure 607

2 Localized erosion is acceptable provided the TE thickness is more than 0.008 inch (0.2032 mm) deep.

3 Inspect airfoil trailing edge slots and all cooling holes for blockage. Reject if cleaning does not remove blockage.

4 If the slot width is more than 0.001 in. (0.0254 mm), one dent at TE ejection slot per airfoil is permitted.

5 Reject segment if burnt or missing material is found.

(c) Inner and Outer Shroud - Gas Path Surfaces

1 Non-converging hairline cracks that may extend to airfoil fillet radii are acceptable up to 0.600 inch (15.24 mm) long may be associated with oxidation upto 0.020 inch (0.508 mm) wide.

2 Non-converging hairline cracks with shallow material heavy oxidation not more than 0.020 in. (0.508 mm) wide are permitted.

3 Multi-pronged cracks that cover an area less than 0.30 in. (7.62 mm) in diameter are permitted.

4 Localized erosion confined to coating layer is acceptable.

5 Erosion exposing base material is acceptable on a maximum of 5 areas per airfoil and shroud surface up to 0.100 in. (2.540 mm) in diameter each.

6 Local damage due to nicks, dents or pitting is acceptable up to 0.005 in. (0.127) deep and 0.100 in. (2.540 mm) in diameter.

7 Reject segment if airfoil surface is burnt and missing material is found except as indicated.

(2) Inner & Outer Shroud TE Lips

NOTE: DELETED.

(a) Multiple cracks upto 0.030 in. (0.762 mm) wide are acceptable provided they are a minimum of 0.200 in. (5.08 mm) from the acute angle face and 0.150 in. (3.81 mm) from adjacent crack.

(b) Burning or erosion. Localized burning or erosion upto 0.015 in. (0.381 mm) inch deep is acceptable. Generalized heavy oxidation or erosion upto 0.010 in. (0.254 mm) deep over less than 50% of surface is acceptable.

(c) Local heavy oxidation along the lip surface is permitted upto 0.015 in. (0.381 mm) deep.

(d) Local damage due to nicks, dents or pitting is acceptable up to 0.010 in. (0.254 mm) deep and 0.100 in. (2.540 mm) in diameter.

(3) Inner and Outer Shroud - Non Gas Path Surfaces

(a) Surface cracks are permitted with no visible depth.

(b) DELETED.

(c) Non-converging hairline cracks are acceptable up to 0.600 in. (15.24 mm) long and they do not extend into supporting ribs, insert joints or insert.

(d) Reject if burnt, eroded, (erosion other than coating loss) or missing material is found.

(e) Local damage due to nicks, dents or pitting is acceptable up to 0.010 in. (0.254 mm) deep and 0.100 in. (2.540 mm) in diameter.

(4) Feather Seal Faces

(a) Non-converging hairline cracks are permitted up to 0.200 in. (5.08 mm) long, if they are between the gas path surface and feather seal slot.

(b) Burning or erosion. Localized burning or erosion up to 0.020 in. (0.508 mm) deep is permitted.

(5) Inserts

(a) Cracks on supporting ribs, insert joints or inserts are not acceptable.

(b) Reject segment if insert is distorted.

(c) Reject segment if gaps are found at insert joints.

(6) All Other Surfaces

(a) Cracks are not permitted. Reject segment if cracks are found.

(b) Nicks, dents, scores or scratches on machined surfaces are acceptable up to 0.005 in. (0.127 mm) deep. Blend to remove raised material.

(7) If above limits are exceeded, reject vane segments. Retain segments for future evaluation and possible repair.

12. Second-stage Turbine Vane Ring Assembly (Ref. Fig. 609)

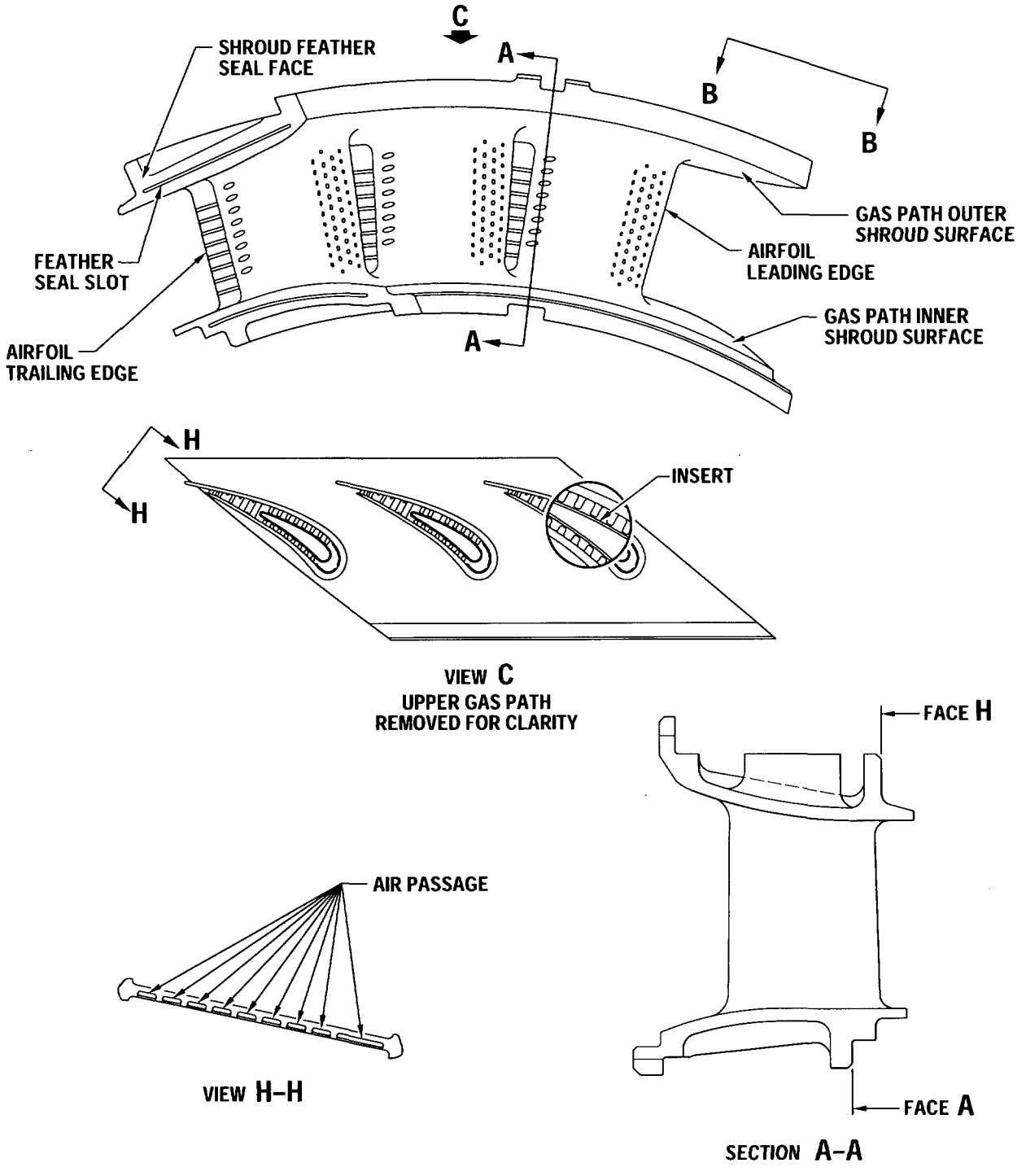
A. Stator Air Seal

(1) Inspect for cracks or distortion. Reject if evident.

(2) Inspect for radial clearance when installed in HP turbine housing. Gap between components not to exceed 0.001 inch (0.02 mm).

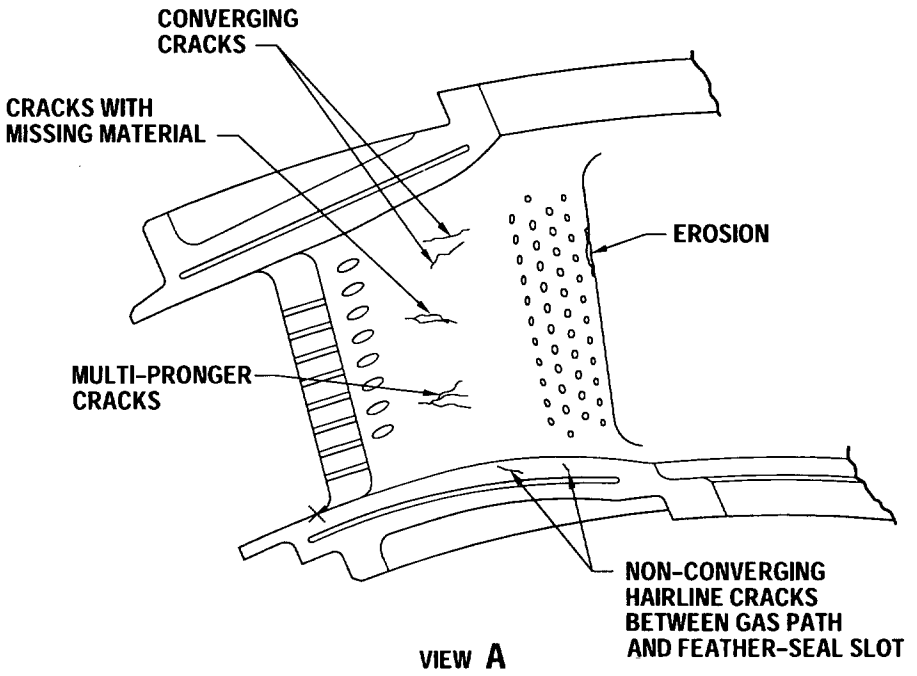
(3) Inspect for evidence of damage, fretting or wear on faces. Acceptable to a maximum depth of 0.002 inch (0.05 mm).

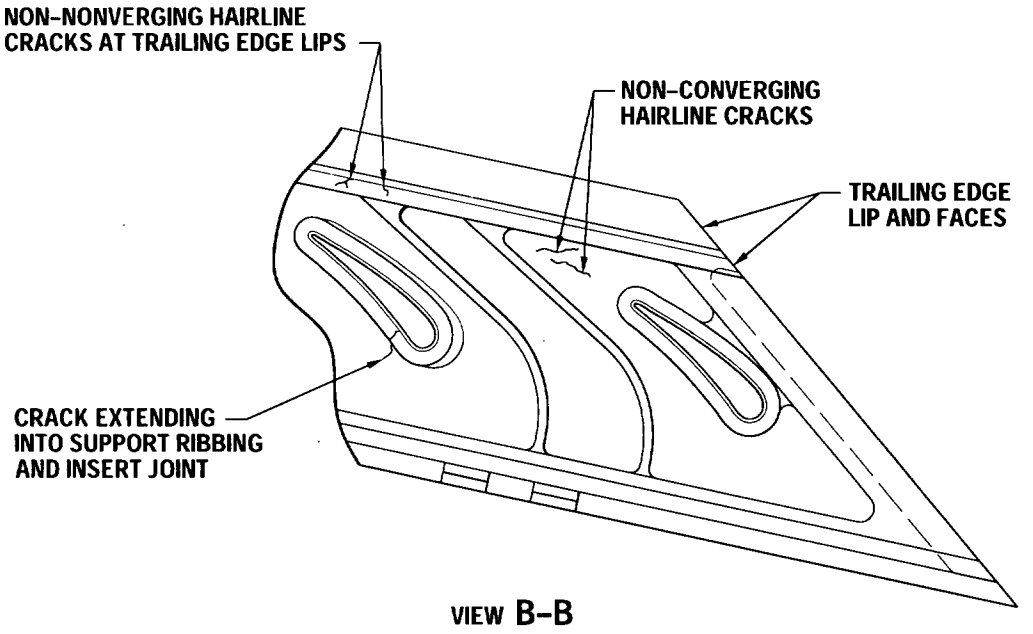
P&WC Proprietary Information. Subject to the restrictions on the title page.



C70138A

HP Turbine Vane Ring Segments (Post-SB24174) - Inspection
Figure 608 (Sheet 1 of 2)




NON-NONVERGING HAIRLINE CRACKS AT TRAILING EDGE LIPS
NON-CONVERGING HAIRLINE CRACKS
TRAILING EDGE LIP AND FACES
CRACK EXTENDING INTO SUPPORT RIBBING AND INSERT JOINT
VIEW B-B

C70139

HP Turbine Vane Ring Segments (Post-SB24174) - Inspection
Figure 608 (Sheet 2)

(4) Inspect for loose or damaged seal retaining rivets. Reject assembly if evident.

(5) Inspect for rubs. Rubs are acceptable on seal surface. Stone to remove raised material.

B. Vane Ring Assembly

(1) Check outer shroud for:

(a) Hairline cracks. Any number of hairline cracks not forming a circular pattern are acceptable, cracks may extend into airfoil.

(b) Through going cracks upto 0.010 in. (0.254 mm) wide which may be associated with a small piece of missing material may extend from the corner of the cooling slot on the outer shroud to the forward edge is acceptable. Cracks may progress into the airfoil fillet radius and the leading edge (Ref. View P-P and R-R) and branch. Cracks forming a closed pattern are not permitted.

(c) Through going cracks extending into the seal ring retaining slot is not acceptable.

(d) Burnt or missing material. Minor burning or oxidation is acceptable.

(2) Check inner shroud for:

(a) Hairline cracks. Multiple hairline cracks originating at the inner shroud rear edge, key hole slots and/or cooling holes, terminating in the baffle support flange are acceptable (Ref. View S-S).

(b) Upto two hairline cracks originating at the inner shroud front edge are permitted. Cracks may extend to the airfoil filet radius.

(c) Open cracks are not acceptable.

(d) Burnt or missing material is not acceptable.

(3) Check airfoil leading edge as follows:

(a) Hairline cracks. Any amount of non-through going hairline cracks are acceptable.

(b) Open cracks. Two open cracks per vane are acceptable up to a maximum of 0.005 inch wide and up to a maximum cumulative length of 0.600 inch.

(c) Minor oxidation of cracked areas is acceptable.

(d) Missing material or multi-branched open cracks is not acceptable.

(4) Check airfoil trailing edge as follows:

(a) Hairline cracks. Any amount of non-through going hairline cracks are acceptable.

(b) Distortion and dents. Trailing edge exhibiting waviness or dents up to a maximum of 0.060 inch are acceptable.

(c) Open cracks, burnt and/or missing material is not acceptable.

(5) Check airfoil pressure and suction surfaces as follows:

(a) Hairline cracks. Any amount of non-through going hairline crack on either side of the airfoil is acceptable.

(b) Open cracks, burnt and/or missing material is not acceptable.

(c) Distortion and dents. Minor bulging on airfoil is acceptable (Ref. View Y).

(6) Check inner and outer location lugs for evidence of wear, cracks or missing lugs.

NOTE: Cracks or missing lugs, return to overhaul facility for repair.

(7) Check sealing cap welds for evidence of cracking.

NOTE: Cracked welds, return to overhaul facility for repair.

(8) Check airfoil and inner platform cooling holes (Post-SB24103) for:

(a) Blockage and evidence of foreign material. Reject if evident.

NOTE: If vane ring has blocked cooling holes, return to overhaul facility for repair.

(9) Check all other surfaces for:

(a) Raised metal and sharp edges. Stone to remove.

(b) Nicks, dents or scoring. Damage is acceptable to a maximum depth of 0.008 inch deep on airfoil surfaces and a maximum of 0.020 inch deep on all other surfaces.

NOTE: When stoning and blending damaged areas make sure the minimum area of surface treatment is removed when performing this procedure.

(10) Visually check for deterioration of surface treatment.

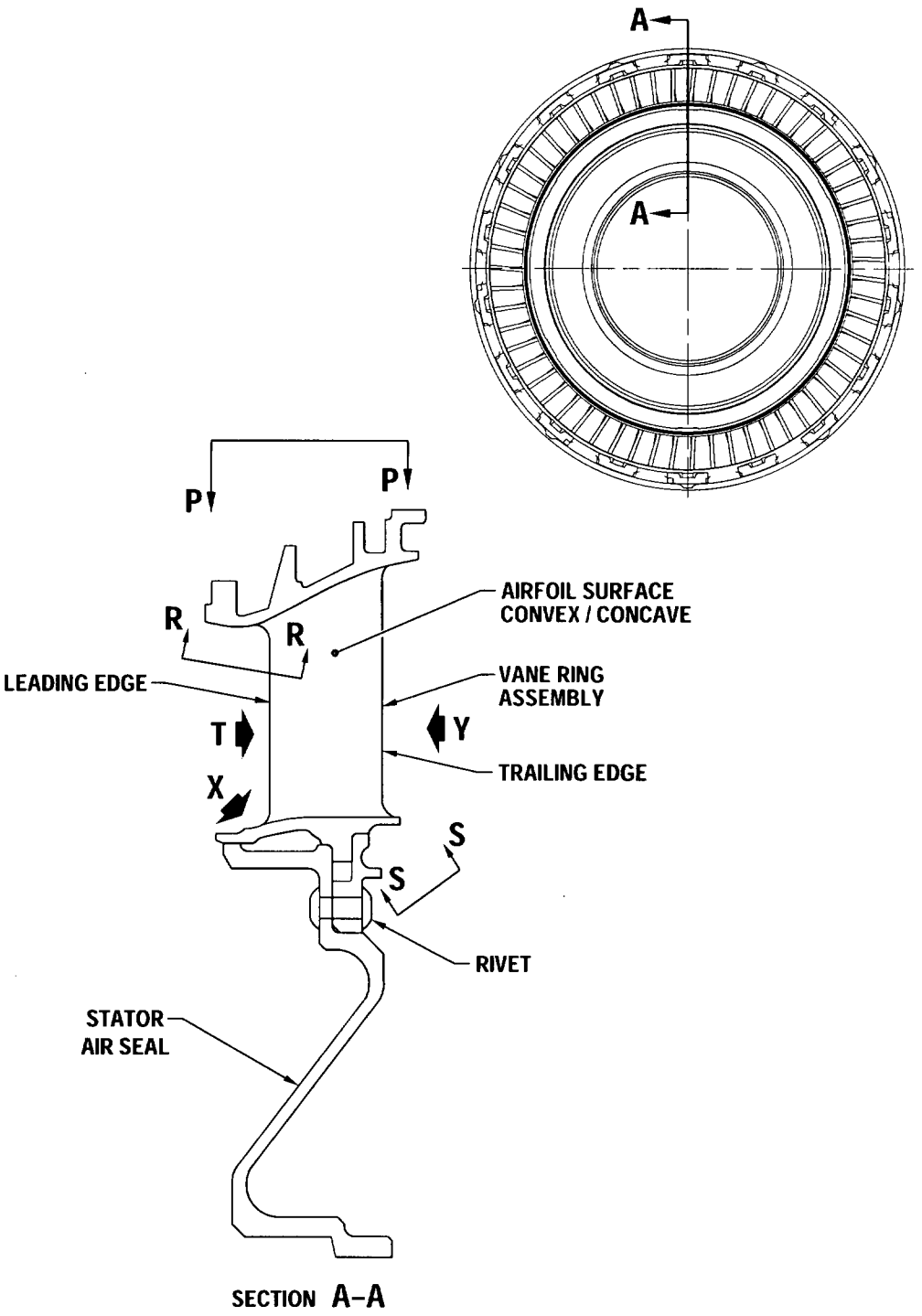
13. Turbine Disk Air Nozzle Assembly (Ref. Fig. 610)

A. Visual Check

(1) Inspect for cracks. No cracks permitted.

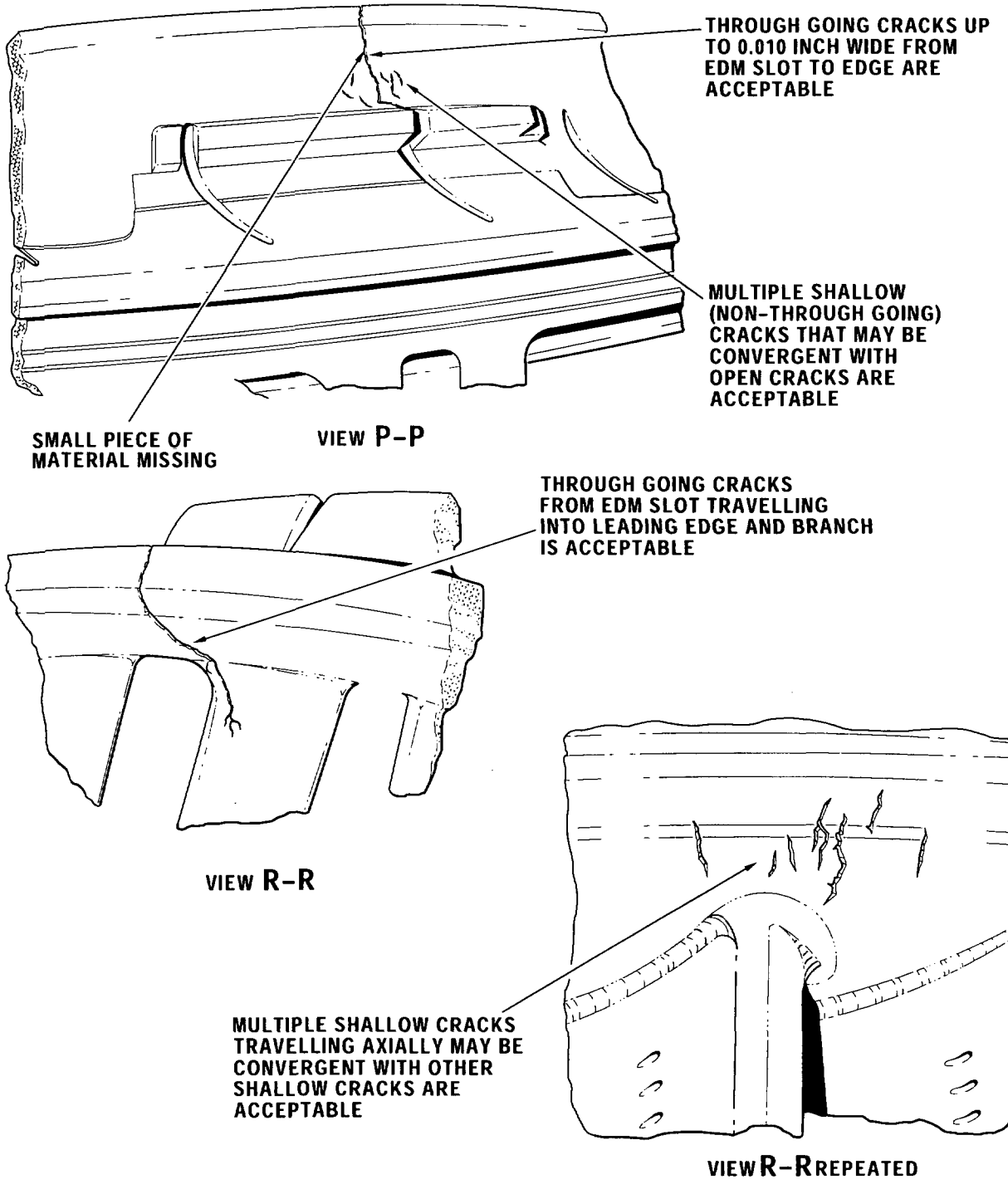
(2) Inspect for nicks or dents. Maximum 10 acceptable to a depth of 0.003 inch (0.08 mm) provided damage is removed by blending to a maximum depth of 0.005 inch (0.13 mm).

(3) Inspect for loose, worn or damaged interstage turbine seal. Reject if loose, damaged or if the depth of wear is in excess of 0.003 inch (0.08 mm).

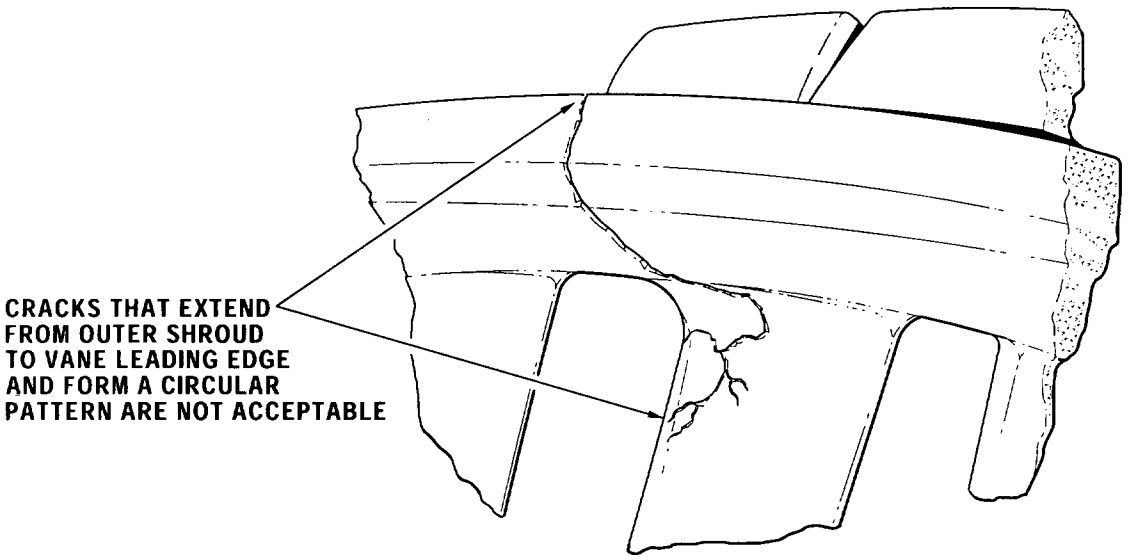


C70071C

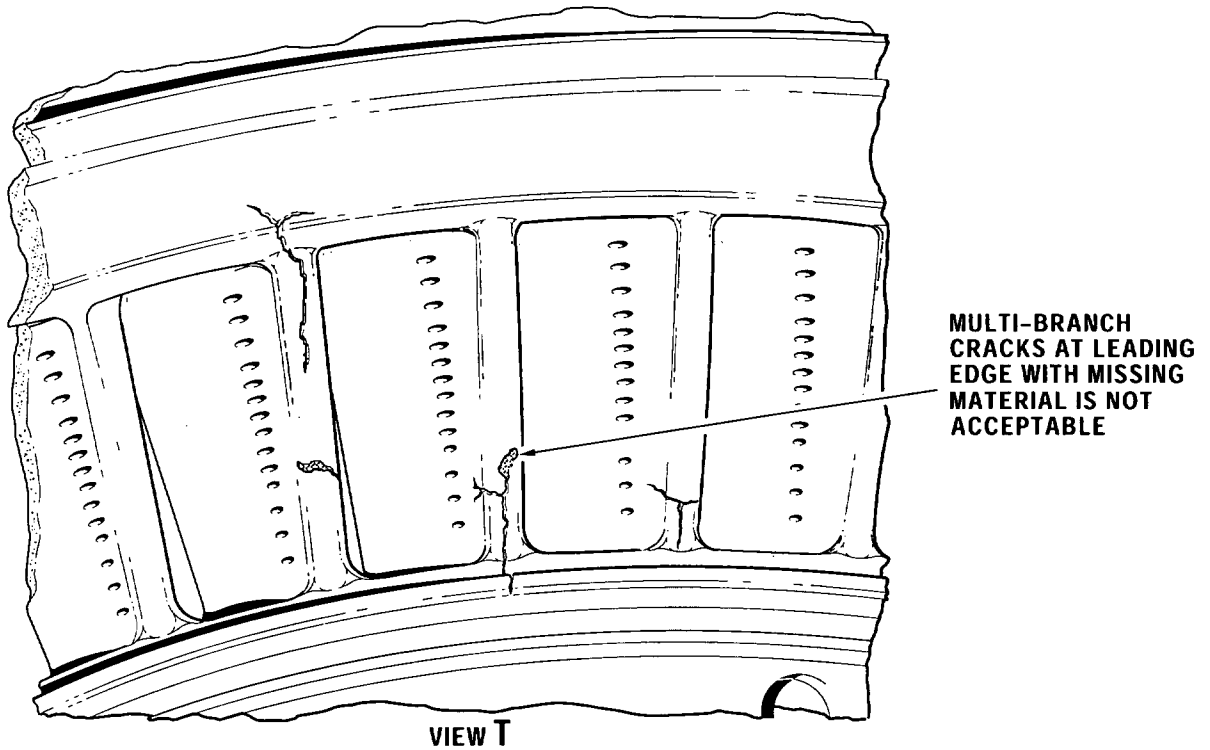
Second-stage Turbine Vane Ring Assembly
Figure 609 (Sheet 1 of 5)


THROUGH GOING CRACKS UP TO 0.010 INCH WIDE FROM EDM SLOT TO EDGE ARE ACCEPTABLE
MULTIPLE SHALLOW (NON-THROUGH GOING) CRACKS THAT MAY BE CONVERGENT WITH OPEN CRACKS ARE ACCEPTABLE
SMALL PIECE OF MATERIAL MISSING
VIEW P-P
THROUGH GOING CRACKS FROM EDM SLOT TRAVELLING INTO LEADING EDGE AND BRANCH IS ACCEPTABLE
VIEW R-R
MULTIPLE SHALLOW CRACKS TRAVELLING AXIALLY MAY BE CONVERGENT WITH OTHER SHALLOW CRACKS ARE ACCEPTABLE
VIEW R-R REPEATED
C75415B

Second-stage Turbine Vane Ring Assembly
Figure 609 (Sheet 2)



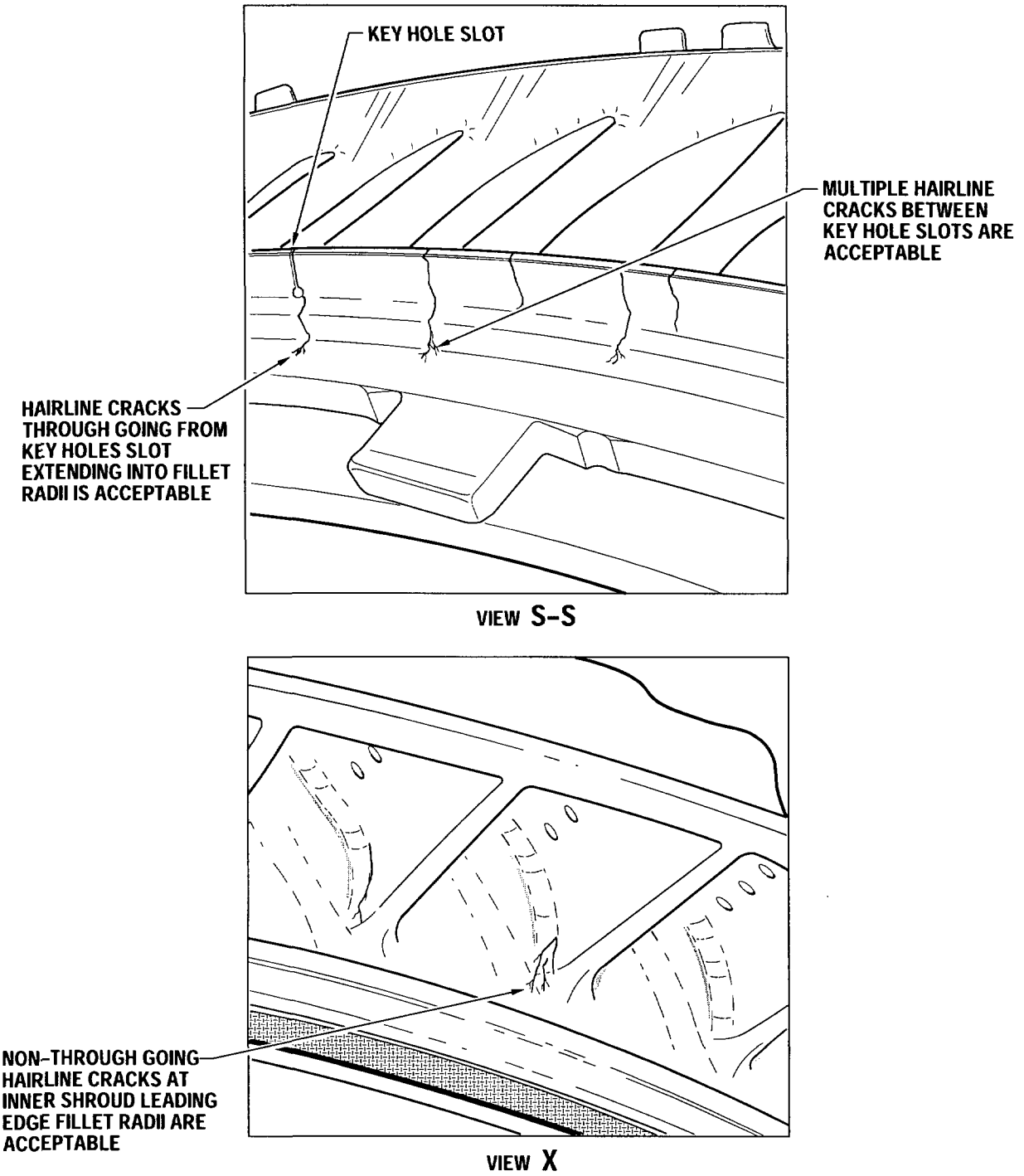
VIEW R–R REPEATED



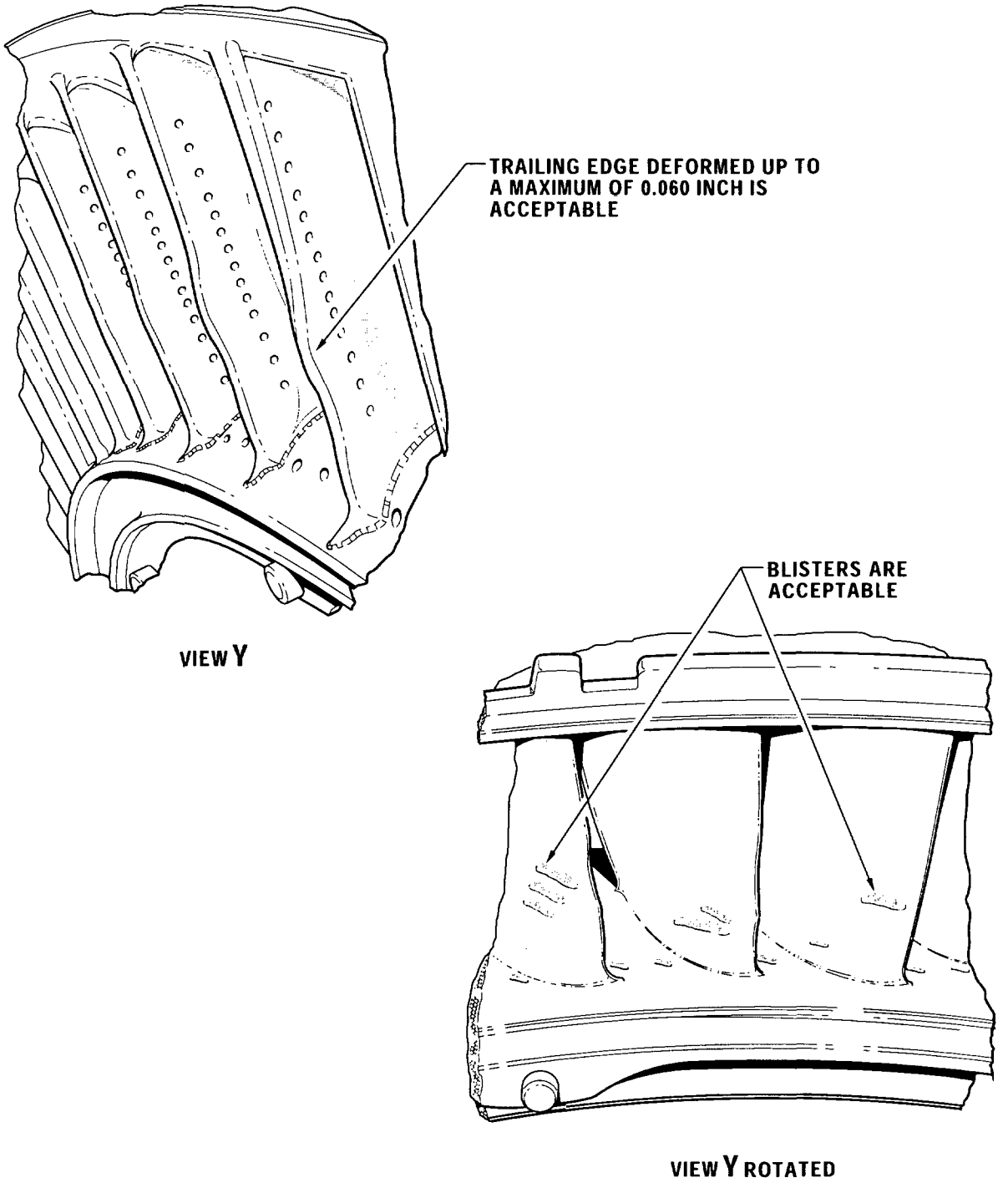
VIEW T

C75416A

Second-stage Turbine Vane Ring Assembly
Figure 609 (Sheet 3)

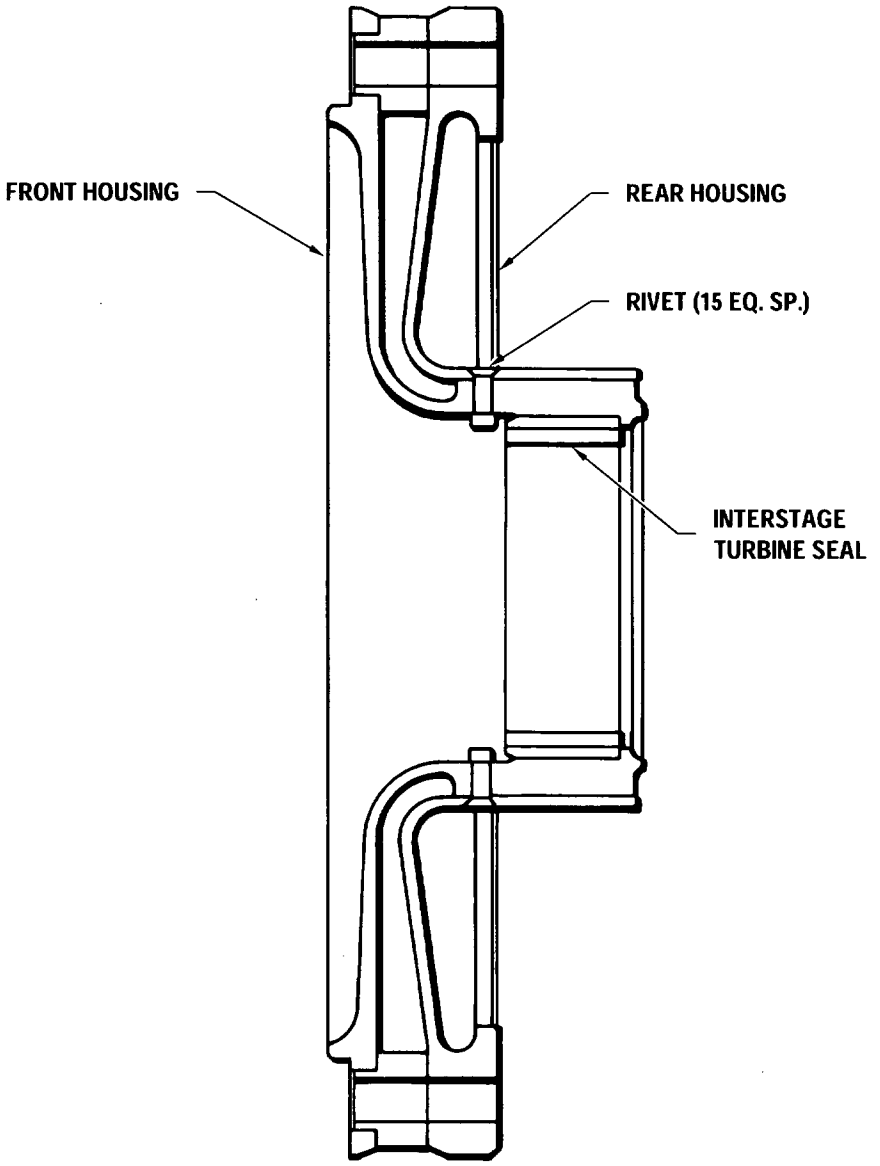

KEY HOLE SLOT
MULTIPLE HAIRLINE CRACKS BETWEEN KEY HOLE SLOTS ARE ACCEPTABLE
HAIRLINE CRACKS THROUGH GOING FROM KEY HOLES SLOT EXTENDING INTO FILLET RADII IS ACCEPTABLE
VIEW S-S
NON-THROUGH GOING HAIRLINE CRACKS AT INNER SHROUD LEADING EDGE FILLET RADII ARE ACCEPTABLE
VIEW X
C75417

Second-stage Turbine Vane Ring Assembly
Figure 609 (Sheet 4)



C75418

Second-stage Turbine Vane Ring Assembly
Figure 609 (Sheet 5)



C18858

Turbine Disk Air Nozzle Assembly
Figure 610

(4) Inspect for security of front and rear housing attachment rivets. Reject assembly if loose or damaged.

14. HP Turbine Spacer

A. Visual Check

(1) Inspect for cracks or deformation. Reject if evident.

15. High Turbine Rotor Air Seal (Ref. Fig. 611)

A. Visual Check

(1) Inspect for cracks. No cracks permitted.

(2) Inspect for damaged knife edge seals. Reject if evident.

NOTE: Any amount of coating loss is acceptable.

(3) Inspect for nicks or dents. Reject if evident.

(4) Inspect for fretting or wear on Dia. A. Acceptable to a maximum depth of 0.002 inch (0.05 mm).

16. No. 3 Bearing Rear Cover Assembly (Ref. Fig. 612)

A. Visual Check

(1) Inspect for cracks. No cracks permitted.

(2) Inspect for nicks or dents. Acceptable to a maximum depth of 0.007 inch (0.18 mm) provided damage is removed by blending to a maximum depth of 0.010 inch (0.25 mm).

(3) Inspect for security of inner and outer cover attachment rivets. Reject assembly if loose or damaged.

17. First-stage HPT Shroud Segments (Ref. Fig. 613)

A. Visual Checks

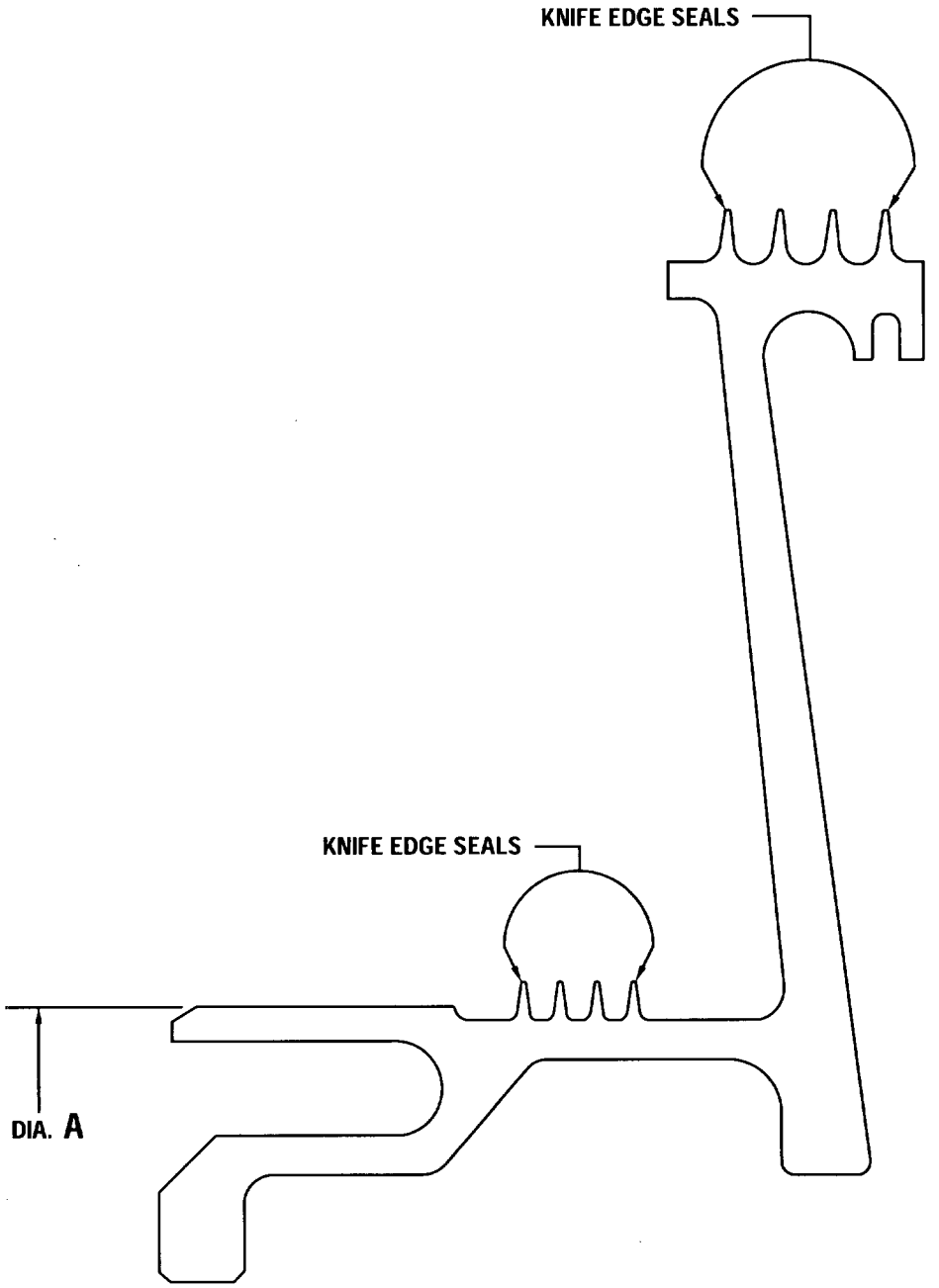
(1) Check area b for:

(a) Cracks. Non-converging hairline cracks are acceptable.

(b) Erosion. Erosion of area b is acceptable up to a maximum of 10 percent over the width of the segment.

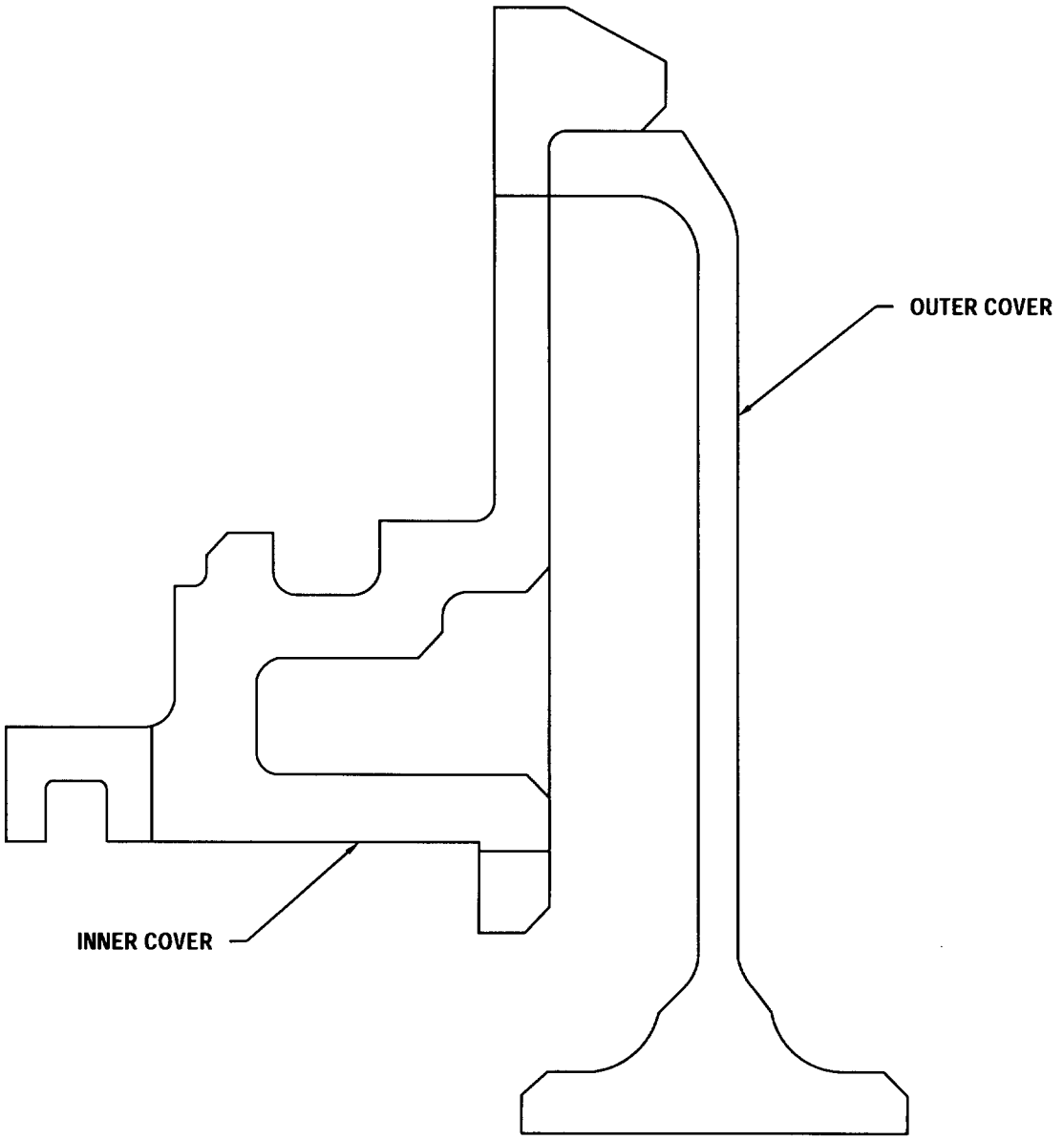
(2) Check area c for:

(a) Loss of coating. Segments with loss of coating may be repaired. Return to overhaul facility for repair.



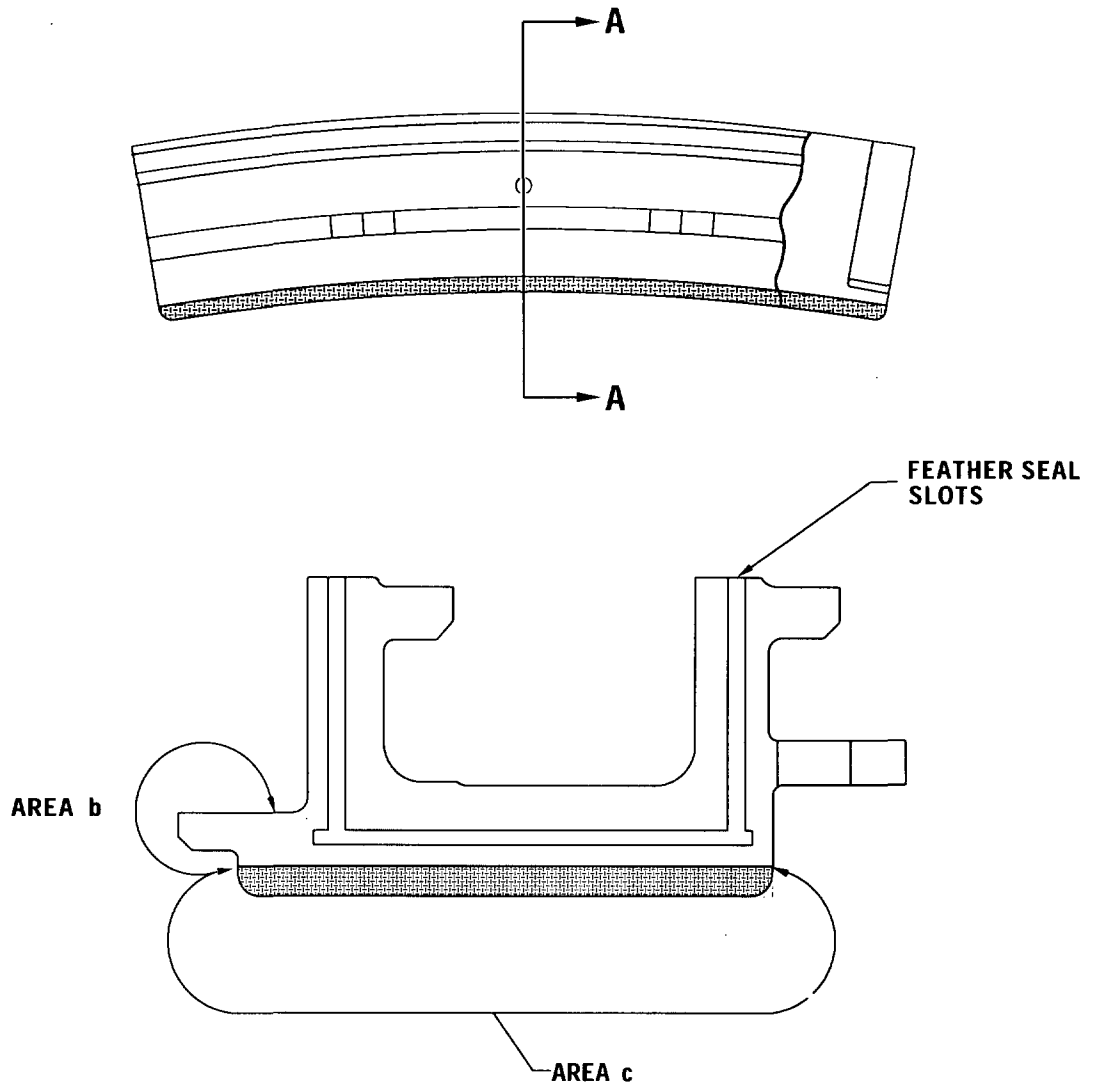
C18849

High Turbine Rotor Air Seal
Figure 611



C18851

No.3 Bearing Rear Cover Assembly
Figure 612



SECTION A-A

C70141

First-stage HPT Shroud Segments
Figure 613

(b) Localized rubbing and raised material. Stone to remove raised material.

(3) Check feather seal slots for:

(a) Raised metal and sharp edges. Stone to remove.

(b) Erosion. Local erosion is acceptable provided wall thickness is not less than 0.025 inch in any one location.

(4) Check all other surfaces for:

(a) Raised metal and sharp edges. Stone to remove.

(b) Cracks. Cracks are acceptable up to a maximum of 0.020 inch deep.

(c) Rubbing or surface erosion. Damage is acceptable up to 0.020 inch deep.

(d) Check air cooling holes are clear and unobstructed. Clean as necessary.

18. Second-stage HPT Shroud Segments (Ref. Fig. 614)

A. Visual Checks

(1) Check area(s) b for:

(a) Cracks. Non-converging hairline cracks are acceptable.

(b) Erosion. Erosion of area b is acceptable up to a maximum of 10 percent over the width of the segment.

(2) Check area c for:

(a) Loss of coating. Segments with loss of coating may be repaired. Return to overhaul facility for repair.

(b) Localized rubbing and raised material. Stone to remove raised material.

(3) Check feather seal slots for:

(a) Raised metal and sharp edges. Stone to remove.

(b) Erosion. Local erosion is acceptable provided wall thickness is not less than 0.025 inch in any one location.

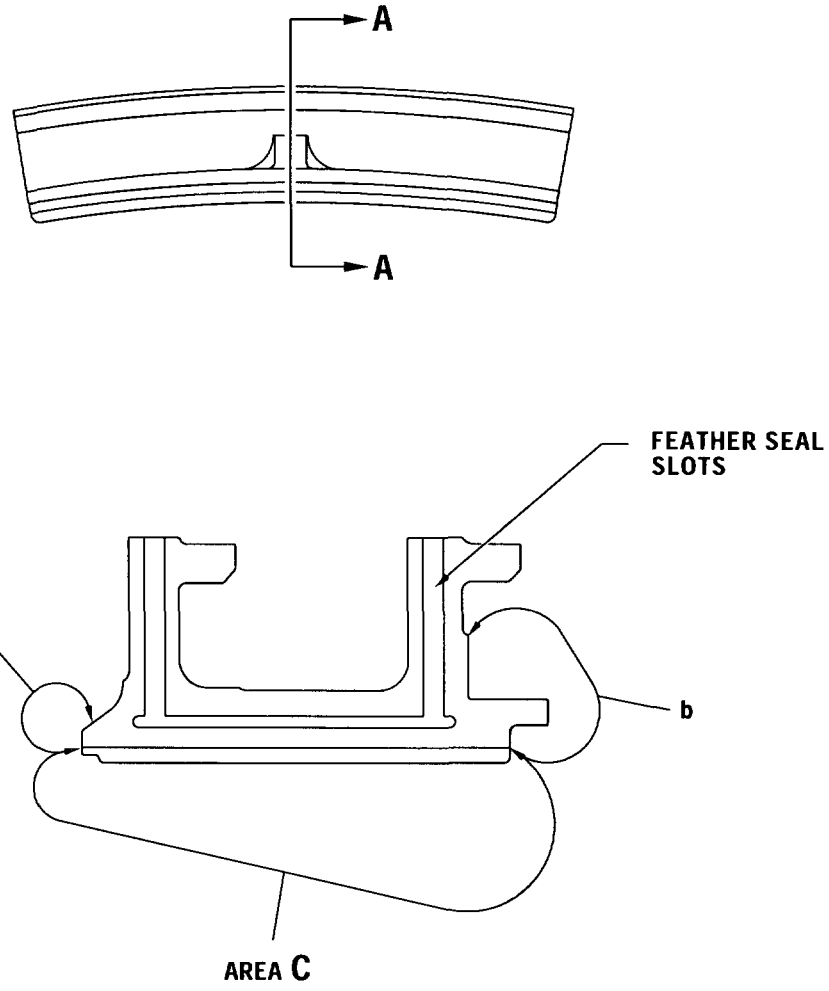
(4) Check all other surfaces for:

(a) Raised metal and sharp edges. Stone to remove.

(b) Cracks. Cracks are acceptable up to a maximum of 0.020 inch deep.

(c) Rubbing or surface erosion. Damage is acceptable up to 0.020 inch deep.

(d) Check air cooling holes are clear and unobstructed. Clean as necessary.



SECTION A-A

C70185

Second-stage HPT Shroud Segments
Figure 614

19. First and Second-stage Shoud Retaining Rings

A. Visual Checks

(1) Check for cracks. Reject if evident.

(2) Check local surface damage, wear or fretting. Acceptable to 0.020 inch deep.

B. Dimensional check

(1) Install ring in HP Turbine housing, check for tightness of fit and retention capability. Reject if loose and/or retaining ring ends do not fit snugly into housing.

20. Fits, Clearances and Torque Loadings

TABLE 601, Fits and Clearances

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1130	Shaft, Stub, Compressor Rotor	3.0493 (77.452)	3.0500 (77.470)	0.0017T (0.043T)	0.0029T (0.074T)	
	Seal, Air, High Turbine Rotor	3.0471 (77.396)	3.0476 (77.409)			
1131	Shaft, Stub, Compressor Rotor	3.0493 (77.452)	3.0500 (77.470)	0.001 (0.025)	0.0037 (0.094)	
	Spacer, Sleeve	3.051 (77.495)	3.053 (77.546)			
1132	Shaft, Stub, Compressor Rotor	3.0493 (77.452)	3.0500 (77.470)	0.0015T (0.038T)	0.0027T (0.069T)	
	Disk, Turbine, HP, First-stage	3.0473 (77.401)	3.0478 (77.414)			
1133	Seal, Air, High Turbine Rotor	4.2491 (107.927)	4.2500 (107.950)	0.006 (0.152)	0.0079 (0.201)	
	Seal, Carbon, No. 3 Bearing	4.256 (108.102)	4.257 (108.128)			
1134	Seal, Carbon, No. 3 Bearing	5.124 (130.150)	5.127 (130.226)	0.0024T (0.061T)	0.007T (0.178T)	
	Cover, No. 3 Bearing, Rear, Inner	5.1200 (130.048)	5.1216 (130.089)			

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1137	Seal, Air, High Turbine Rotor	4.356 (110.642)	4.358 (110.693)	0.017 (0.432)	0.021 (0.533)	
	Cover, No. 3 Bearing, Rear, Assy of	4.375 (111.125)	4.377 (111.176)			
1139	Pre-SB24061 Seal, Air, High Turbine, Front	5.063 (128.600)	5.065 (128.651)	0.021 (0.533)	0.025 (0.635)	
	Nozzle, Air, Turbine Disk, Assy of	5.086 (129.184)	5.088 (129.235)			
1139	Post-SB24061/Pre-SB24062 Seal, Air, High Turbine, Front	5.063 (128.600)	5.065 (128.651)	0.020 (0.508)	0.024 (0.610)	
	Nozzle, Air, Turbine Disk, Assy of	5.085 (129.159)	5.087 (129.210)			
1139	PW305A, PW305B or Post-SB24062 Seal, Air, High Turbine, Front	5.063 (128.600)	5.065 (128.651)	0.020 (0.508)	0.024 (0.610)	
	Nozzle, Air, Turbine Disk, Assy of	5.085 (129.160)	5.087 (129.210)			
1144	Seal, Air, High Turbine Rotor	7.664 (194.666)	7.665 (194.691)	0.032 (0.813)	0.035 (0.889)	
	Support, Seal, Air, Assy of	7.697 (195.504)	7.699 (195.555)			
1148	Post-SB24174 Seal, Turbine Stator, Assy Of	8.101 205.765	8.103 205.816	0.004 0.101	0.008 0.203	
	Nozzle, Air, Turbine Disk, Rear	8.107 205.918	8.109 205.969			

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1149	Pre-SB24063 Cover, HP Turbine, Front	6.299 (159.995)	6.301 (160.045)	0.045 (1.143)	0.050 (1.270)	
	Seal, Turbine Stator, Assy of	6.346 (161.188)	6.349 (161.265)			
1149	Post-SB24063/Pre-SB24138 Cover, HP Turbine, Front	6.317 (160.452)	6.323 (160.604)	0.023 (0.584)	0.032 (0.813)	
	Seal, Turbine Stator, Assy of	6.346 (161.188)	6.349 (161.265)			
1149	PW305A, PW305B or Post-SB24138 Cover, HP Turbine, Front	6.317 (160.452)	6.323 (160.604)	0.054 (1.372)	0.062 (1.575)	
	Seal, Turbine Stator, Assy of	6.377 (161.976)	6.379 (162.027)			
1150	Pre-SB24063 Cover, HP Turbine, Front	6.409 (162.789)	6.411 (162.839)	0.045 (1.143)	0.050 (1.270)	
	Seal, Turbine Stator, Assy of	6.456 (163.982)	6.459 (164.059)			
1150	Post-SB24063/Pre-SB24138 Cover, HP Turbine, Front	6.427 (163.246)	6.433 (163.398)	0.023 (0.584)	0.032 (0.813)	
	Seal, Turbine Stator, Assy of	6.456 (163.982)	6.459 (164.059)			
1150	PW305A, PW305B or Post-SB24138 Cover, HP Turbine, Front	6.427 (163.246)	6.433 (163.398)	0.054 (1.372)	0.062 (1.575)	
	Seal, Turbine Stator, Assy of	6.487 (164.769)	6.489 (164.821)			

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1151	Pre-SB24138 Nozzle, Air, Turbine Disk, Rear	9.407 (238.938)	9.409 (238.989)	0.006T (0.152T)	0.010T (0.254T)	
	Shroud, Vane, HP Turbine, First-stage	9.399 (238.735)	9.401 (238.785)			
1151	PW305A, PW305B or Post-SB24138 Pre-SB24174 Nozzle, Air, Turbine Disk, Rear	9.407 (238.938)	9.409 (238.989)	0.0005L (0.0127L)	0.0035T (0.089T)	
	Shroud, Vane, HP Turbine, First-stage	9.4055 (238.900)	9.4075 (238.951)			
1151	Post-SB24174 Nozzle, Air Turbine Disk, Rear	9.407 238.938	9.409 238.989	0.0005 0.013	0.0035T 0.089T	
	Shroud, Vane, HP Turbine, First Stage	9.4055 238.900	9.4075 238.950			
1154	Pre-SB24063 Cover, HP Turbine, Front	10.207 (259.258)	10.209 (259.308)	0.040 (1.016)	0.045 (1.143)	
	Seal, Turbine Stator, Assy of	10.249 (260.325)	10.252 (260.401)			
1154	Post-SB24063/Pre-SB24134 Cover, HP Turbine, Front	10.225 (259.715)	10.231 (259.867)	0.018 (0.457)	0.027 (0.686)	
	Seal, Turbine Stator, Assy of	10.249 (260.325)	10.252 (260.401)			
1154	PW305A, PW305B or Post-SB24134 Cover, HP Turbine, Front	10.225 (259.715)	10.231 (259.867)	0.058 (1.473)	0.069 (1.753)	
	Seal, Turbine Stator, Assy of	10.289 (261.341)	10.294 (261.468)			

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1154	PW305A, PW305B or Pre-SB24138 Cover, HP Turbine, Front	10.219 (259.563)	10.221 (259.613)	0.068 (1.727)	0.075 (1.905)	
	Seal, Turbine Stator, Assy of	10.289 (261.341)	10.294 (261.468)			
1154	PW305A, PW305B or Post-SB24138 Cover, HP Turbine, Front	10.225 (259.715)	10.231 (259.867)	0.062 (1.575)	0.071 (1.803)	
	Seal, Turbine Stator, Assy of	10.293 (260.325)	10.296 (260.401)			
1155	Pre-SB24063 Cover, HP Turbine, Rear	10.299 (261.595)	10.301 (261.645)	0.036 (0.914)	0.041 (1.041)	
	Turbine Stator, Assy of	10.337 (262.560)	10.340 (262.636)			
1155	PW305A, PW305B or Post-SB24063, Pre-SB24102 Cover, HP Turbine, Rear	10.321 (262.153)	10.327 (262.306)	0.018 (0.466)	0.027 (0.699)	
	Turbine Stator, Assy of	10.345 (262.763)	10.348 (262.839)			
1155	Post-SB24102, Pre-SB24135 Cover, HP Turbine, Rear	10.321 (262.153)	10.327 (262.306)	*0.030* (0.762)	*0.038* (0.965)	
	Turbine Stator, Assy of	10.357 (263.068)	10.359 (263.119)			

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1155	Post-SB24135 Machine turbine stator seal diameters concentric within 0.001 of gas generator case No. 3 bearing bore, when turbine stator assy. is positioned at midpoint of vertical and horizontal play in HPT housing.			0.025 (0.635) Radial Clearance Cold	0.029 (0.737)	
1157	Pre-SB24063 Cover, HP Turbine, Rear	6.359 (161.519)	6.361 (161.569)	0.0455 (1.156)	0.0505 (1.283)	
	Turbine Stator, Assy of	6.4065 (162.725)	6.4095 (162.801)			
1157	PW305A, PW305B or Post-SB24063, Pre-SB24102 Cover, HP Turbine, Rear	6.239 (158.471)	6.245 (158.569)	0.018 (0.458)	0.027 (0.686)	
	Turbine Stator, Assy of	6.263 (159.080)	6.266 (159.156)			
1157	Post-SB24102, Pre-SB24135 Cover, HP Turbine, Rear	6.239 (158.471)	6.245 (158.623)	0.022 (0.559)	0.030 (0.762)	
	Turbine Stator, Assy of	6.267 (159.182)	6.269 (159.233)			

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TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1157	Post-SB24135 Machine turbine stator seal diameters concentric within 0.001 of gas generator case No. 3 bearing bore, when turbine stator assy. is positioned at midpoint of vertical and horizontal play in HPT housing.			0.011 (0.279) Radial Clearance Cold	0.015 (0.381)	
1158	Pre-SB24063 Cover, HP Turbine, Rear	6.239 (158.471)	6.241 (158.521)	0.0405 (1.029)	0.0455 (1.156)	
	Turbine Stator, Assy of	6.2815 (159.550)	6.2845 (159.626)			
1158	PW305A, PW305B or Post-SB24063 Not Applicable					
1159	Pre-SB24063 Cover, HP Turbine, Rear	6.119 (155.423)	6.121 (155.473)	0.0385 (0.978)	0.0435 (1.105)	
	Turbine Stator, Assy of	6.1595 (156.451)	6.1625 (156.527)			
1159	PW305A, PW30B or Post-SB24063, Pre-SB24102 Cover, HP Turbine, Rear	6.021 (152.933)	6.027 (153.086)	0.018 (0.457)	0.027 (0.686)	
	Turbine Stator, Assy of	6.045 (153.543)	6.048 (153.619)			

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1159	Post-SB24102, Pre-SB24135 Cover, HP Turbine, Rear	6.021 (152.933)	6.027 (153.086)	0.022 (0.559)	0.030 (0.762)	
	Turbine Stator, Assy of	6.267 (153.645)	6.269 (153.695)			
1159	Post-SB24135 Machine turbine stator seal diameters concentric within 0.001 of gas generator case No. 3 bearing bore, when turbine stator assy. is positioned at midpoint of vertical and horizontal play in HPT housing.			0.011 (0.279) Radial Clearance Cold	0.015 (0.381)	
1160	Pre-SB24063 Cover, HP Turbine, Rear	5.999 (152.375)	6.001 (152.425)	0.0375 (0.953)	0.0425 (1.079)	
	Turbine Stator, Assy of	6.0385 (153.378)	6.0415 (153.454)			
1160	Post-SB24063 Not Applicable					
1161	Pre-SB24102 Seal - Turbine Stator, Assy Of	10.608 (269.443)	10.610 (269.494)	0.014T (0.356T)	0.018T (0.457T)	
	Vane Ring - Turb, 2nd-Stg	10.592 (269.037)	10.594 (269.088)			
1161	Post-SB24102, Pre-SB24103 Seal - Turbine Stator, Assy Of	10.594 (269.088)	10.596 (269.138)	0.000 (0.000)	0.004T (0.102T)	
	Vane Ring - Turb, 2nd-Stg	10.592 (269.037)	10.594 (269.088)			

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1161	Post-SB24103 Seal - Turbine Stator, Assy Of	10.597 (269.164)	10.599 (269.215)	0.002T (0.051T)	0.007T (0.178T)	
	Vane Ring - Turb, 2nd-Stg	10.592 (269.037)	10.595 (269.113)			
1162	Pre-SB24102 Seal - Air, Turb Stator	10.742 (272.847)	10.744 (272.898)	0.000 (0.000)	0.004T (0.102T)	
	Vane Ring - Turb, 2nd-Stg	10.740 (272.796)	10.742 (272.847)			
1162	Post-SB24102, Pre-SB24103 Seal - Air, Turb Stator	10.728 (272.491)	10.730 (272.542)	0.010 (0.254)	0.014T (0.356T)	
	Vane Ring - Turb, 2nd-Stg	10.740 (272.796)	10.742 (272.847)			
1162	Post-SB24103, Pre-SB24180 Seal - Air, Turb Stator	10.728 (272.491)	10.730 (272.542)	0.008 (0.203)	0.016T (0.016T)	
	Vane Ring - Turb, 2nd-Stg	10.738 (272.745)	10.744 (272.898)			
1162	Post-SB24180 Seal - Air, Turb Stator	10.710 (272.034)	10.730 (272.542)	0.008L (0.203)	0.034L (0.864T)	
	Vane Ring - Turb, 2nd-Stg	10.738 (272.745)	10.744 (272.898)			
1217	Pre-SB24103 Housing, HP Turbine, Assy of	16.021 (406.933)	16.023 (407.984)	0.002T (0.051T)	0.006T (0.152T)	
	Case, Combustion Chamber, Outer Assy of	16.017 (406.832)	16.019 (406.883)			

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1217	PW305A, PW305B or Post-SB24103 Housing, HP Turbine, Assy of	16.022 (406.959)	16.024 (407.010)	0.003T (0.076T)	0.007T (0.178T)	
	Case, Combustion Chamber, Outer Assy of	16.017 (406.832)	16.019 (406.883)			
1218	Pre-SB24103 Housing, HP Turbine, Assy of	16.023 (406.984)	16.025 (407.035)	0.002T (0.051T)	0.006T (0.152T)	
	Case, Assy of, Turbine	16.019 (406.883)	16.021 (406.933)			
1218	PW305A, PW305B or Post-SB24103 Housing, HP Turbine, Assy of	16.021 (406.933)	16.023 (406.984)	0.000 (0.000)	0.004T (0.102T)	
	Case, Assy of, Turbine	16.019 (406.883)	16.021 (406.933)			
1219	Pre-SB24103 Baffle, HP Turbine, Assy of	15.8198 (401.823)	15.8238 (401.925)	0.0022 (0.056)	0.0058T (0.147T)	
	Housing, HP Turbine, Assy of	15.818 (401.777)	15.822 (401.879)			
1219	PW305A, PW305B or Post-SB24103 Baffle, HP Turbine, Assy of	15.8198 (401.823)	15.8238 (401.925)	0.0032 (0.081)	0.0048T (0.122T)	
	Housing, HP Turbine, Assy of	15.819 (401.803)	15.823 (401.904)			
1220	Baffle, HP Turbine, Assy of	16.009 (406.629)	16.017 (406.832)	0.000 (0.000)	0.010 (0.254)	
	Case, Combustion Chamber, Outer, Assy of	16.017 (406.832)	16.019 (406.883)			

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1222	Pre-SB24102 Housing, HP Turbine, Assy of	14.6615 (372.402)	14.6637 (372.458)	0.0010T (0.025T)	0.0067T (0.170T)	
	Baffle, HP Turbine, Assy of	14.6570 (372.288)	14.6605 (372.377)			
1222	Post-SB24102, Pre-SB24103 Housing, HP Turbine, Assy of	14.6114 (371.130)	14.6136 (371.185)	0.0010T (0.025T)	0.0067T (0.170T)	
	Baffle, HP Turbine, Assy of	14.6069 (371.015)	14.6104 (371.104)			
1222	PW305A, PW305B or Post-SB24103, Pre-SB24411 Housing, HP Turbine, Assy of	14.8669 (377.619)	14.8691 (377.675)	0.0010T (0.025T)	0.0067T (0.170T)	
	Baffle, HP Turbine, Assy of	14.8624 (377.505)	14.8659 (377.594)			
1222	Post-SB24411, Pre-SB24325 Housing, HP Turbine, Assy of	14.881 (377.977)	14.884 (378.053)	0.006T (0.152T)	0.014T (0.356T)	
	Baffle, HP Turbine, Assy of	14.870 (377.698)	14.875 (377.825)			
1222	Post-SB24325 Housing, HP Turbine, Assy. of	14.8669 (377.619)	14.8691 (377.675)	0.0009L (0.0229L)	0.0081L (0.2057L)	
	Baffle, HP Turbine, Assy. of	14.870 (377.698)	14.875 (377.825)			
1225	PW305 or Pre-SB24144 HPT First-stage (Fit to)			0.025 (0.635)	0.031 (0.787)	
	HPT Shroud Segment First-stage (Fit to)			Radial Clearance Cold HPT1		

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
	NOTE: The selected shroud class is to be ground within 0.001 (0.025) of true position.					
	NOTE: From the shroud measurements and fixed rotor diameter the difference in diameter must be 0.056 ± 0.003 (1.42 ± 0.076) for HPT1. The average clearance is to be within the limits specified. The shroud segments are to be machined if necessary.					
1225	PW305A, PW305B or Post-SB24144 Segment, shroud, HP Turbine - First-stage (Fit to) HP Turbine - First-stage Disk Assy (Fit to)	12.994 (330.048)	12.997 (330.124)	0.028 (0.711) Radial Clearance Cold See Note	0.038 (0.965)	12.979 (329.667) Min.Dia.
	NOTE: The selected shroud class is to be ground within 0.001 in. (0.025 mm) of true position.					
	NOTE: From the shroud measurement and fixed rotor diameter the difference in diameter must be 0.066 in. (1.676 mm) ± 0.010 in. (0.254 mm) for HPT1. The average clearance is to be within the limits specified. The shroud segments are to be machined if necessary.					
1225	PW305 or Pre-SB24144 HPT Second-stage (Fit to) HPT Shroud Segment Second-stage (Fit to)			0.030 (0.762) Radial Clearance Cold HPT2	0.036 (0.914)	
	NOTE: The selected shroud class is to be ground within 0.001 (0.025) of true position.					
	NOTE: From the shroud measurements and fixed rotor diameter the difference in diameter must be 0.066 ± 0.003 (1.68 ± 0.076) for HPT2. The average clearance is to be within the limits specified. The shroud segments are to be machined if necessary.					

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1225	PW305A, PW305B or Post-SB24144 Segment, shroud, HP Turbine - Second-stage (Fit to) HP Turbine - Second-stage Disk Assy (Fit to)	13.840 (351.536)	13.843 (351.612)	0.034 (0.864) Radial Clearance Cold See Note	0.044 (1.118)	13.821 (351.053) Min.Dia.
	NOTE: The selected shroud class is to be ground within 0.001 in. (0.025 mm) of true position.					
	NOTE: From the shroud measurement and fixed rotor diameter the difference in diameter must be 0.078 in. (1.981 mm) ± 0.010 in. (0.254 mm) for HPT2. The average clearance is to be within the limits specified. The shroud segments are to be machined if necessary.					
1226	Pre-SB24490 or Pre-SB24516 Liner - Comb Chmbr, Assy Of	10.045 (255.143)	10.048 (255.219)	0.002 (0.051)	0.008 (0.203)	
	Shrd - Vane, HP Turb, First-Stg	10.050 (255.270)	10.053 (255.346)			
1226	Post-SB24490 or Post-SB24516 Liner , Inner, Comb Chmbr, Assy Of	10.042 (255.067)	10.045 (255.143)	0.005 (0.127)	0.011 (0.279)	
	Vane Assembly, HP Turb, First-Stg	10.050 (255.067)	10.053 (255.346)			
1284	Vane Assy, HP Turbine, First-stage Rotor Balancing Assy, HP			0.059 (1.499) AXIAL	0.061 (1.549)	

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1285	Pre-SB24067 Housing, HP Turbine, Assy of (Backface) Shaft, Low Compressor			2.757 (70.028) AXIAL	2.763 (70.180)	
1285	PW305A, PW305B or Post-SB24067 Housing, HP Turbine, Assy of (Backface) Shaft, Low Compressor			2.769 (70.333) AXIAL	2.775 (70.485)	
1319	PW305A, PW305B or Post-SB24065 Shroud Segment Assy, HP Turbine, First-stage Shroud, Vane, HP Turbine, First-stage			0.010 (0.254) AXIAL	0.015 (0.381)	
1320	Post-SB24102 Seal - Turbine Stator Seal - Air, Turbine Stator	9.590 (243.586) 9.588 (243.535)	9.592 (243.637) 9.592 (243.637)	0.002 (0.051)	0.004T (0.102T)	
1321	PW305A, PW305B or Post-SB24103 Seal, Turbine Stator Seal, Air, Turbine Stator	10.619 (269.723) 10.614 (269.596)	10.621 (269.773) 10.617 (269.672)	0.002T (0.051T)	0.007T (0.178T)	
1390	Post-SB24419 Vane Ring - Turbine, 2-Stage Assy of Rotor Balancing Assembly - HP			0.075 (1.905) Axial	0.080 (2.032)	

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1851	HP Turbine Vane, First-stage (Flow Area Limits/Class Selection)			11.56 sq.in. 11.69 sq.in. (7458sq.mm.) (7542sq.mm.)		

TABLE 602, Torque and Stretch

REF. NO.	Name	Limits Min.	Limits Max.
1704	Bolt, Machine	57 (6.44)	64 (7.23)

1705 Nut, Plain, Round, 2.750 - 16J

CAUTION: LUBRICATE THREADS AND THRUST FACES OF NUT, SHAFT AND REAR SEAL WITH ANTI-SEIZE COMPOUND (PWC06-009) PRIOR TO EACH TIGHTENING.

(1) Tighten nut 840 to 960 lb.in. (95-108 Nm).

(2) Establish common reference points between nut and its mating part.

(3) Turn nut through further angle of 58 to 60 degrees.

(4) Loosen nut 0.0 lb.in. (0.0 Nm) and repeat step (1).

(5) If nut reference point is in line with the mating part reference point or beyond it within 3.5 degrees Max, apply final angle of turn per step (3).

(6) If nut reference points are not within limits, repeat steps (2), (5) and (4) in order until reference points are within limits, then perform step (6).

1706 Nut Retaining

NOTE: Lubricate threads with engine oil.

(1) Tighten nut 756 to 1260 lb.in. (85.4-142.4 Nm) Turn nut thru angle of 53 to 56 degrees and loosen 0 lb.in. (0 Nm).

(2) Tighten nut 444 to 780 lb.in. (50.2- 88.1 Nm).

(3) Establish common reference points between nut and shaft.

(4) Turn nut through further angle of 39 to 42 degrees.

TABLE 602, Torque and Stretch (Cont'd)

REF. NO.	Name	Limits Min.	Limits Max.
	(5) Loosen nut 0 lb.in. (0 Nm), and repeat step 2.		
	(6) If nut reference points are in line with mating part reference point or beyond it within 3.9 degrees Max, apply final angle of turn per step 4.		
	(7) If the reference points are not within limits, repeat steps 3, 4 and 5 in order until reference points are within limits, then perform step 6.		

TABLE 603, Spring Pressures

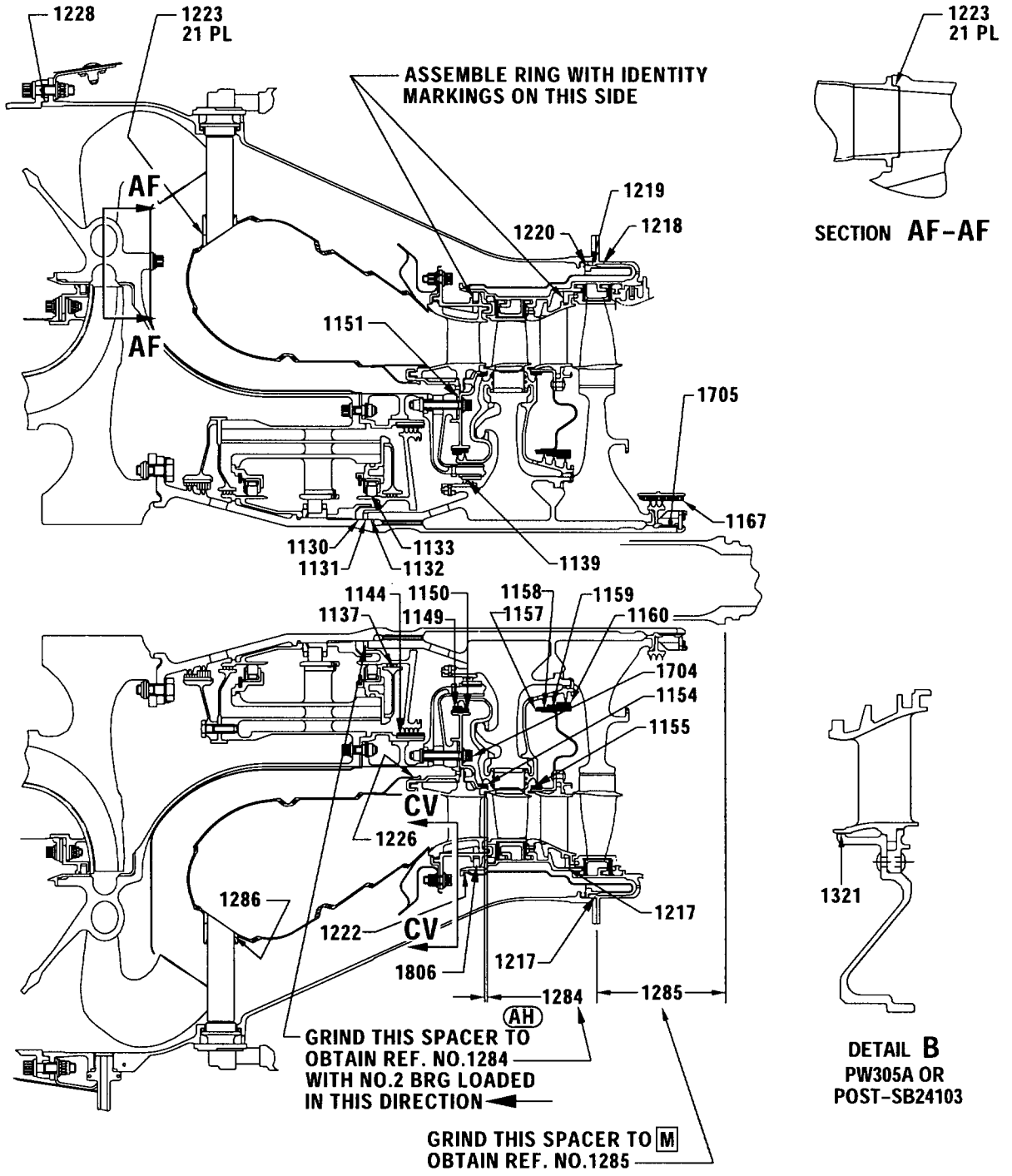
REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		

TABLE 604, Special Assembly Procedures

REF. NO.	Name	Limits Min.	Limits Max.
1802	Shroud Segment, HP Turbine, First-stage (Gap)	0.016 (0.40)	0.020 (0.51)
1803	Shroud Segment, HP Turbine, Second-stage (Gap)	0.016 (0.40)	0.020 (0.51)
1806	Fit Between HP Turbine Housing and Seal Rings		
	(1) A 0.002 (0.051 mm) inch feeler gauge must not pass between diameters. A 0.001 (0.0025 mm) inch feeler gauge must not pass between these diameters thru an arc of more than 60 degrees total.		
1808	Vane - HP Turbine, First-stage (gap)	0.011 (0.28)	0.019 (0.48)

TABLE 605, Backlash

REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		



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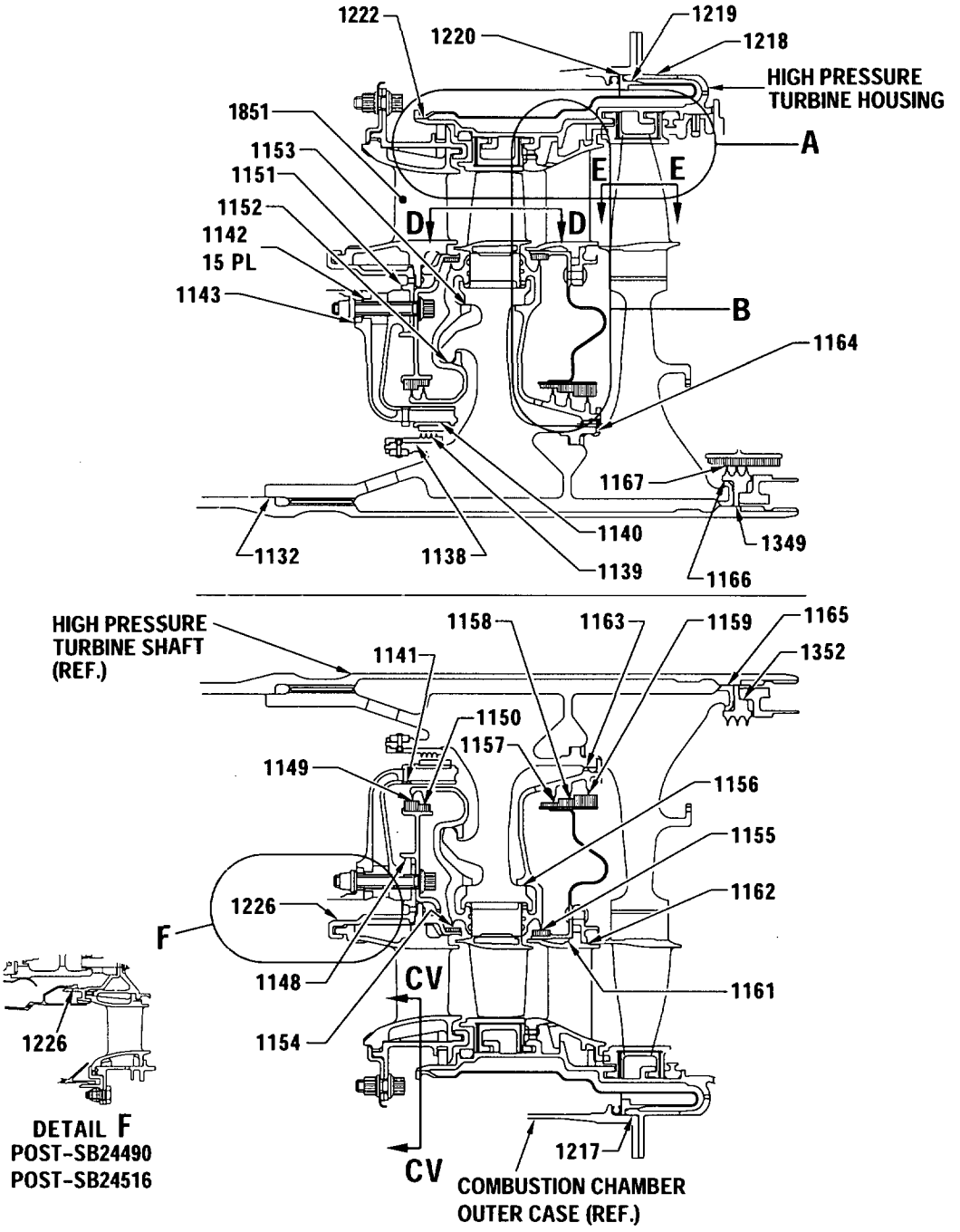
HP Turbines - Fits and Clearances
Figure 615 (Sheet 1 of 9)



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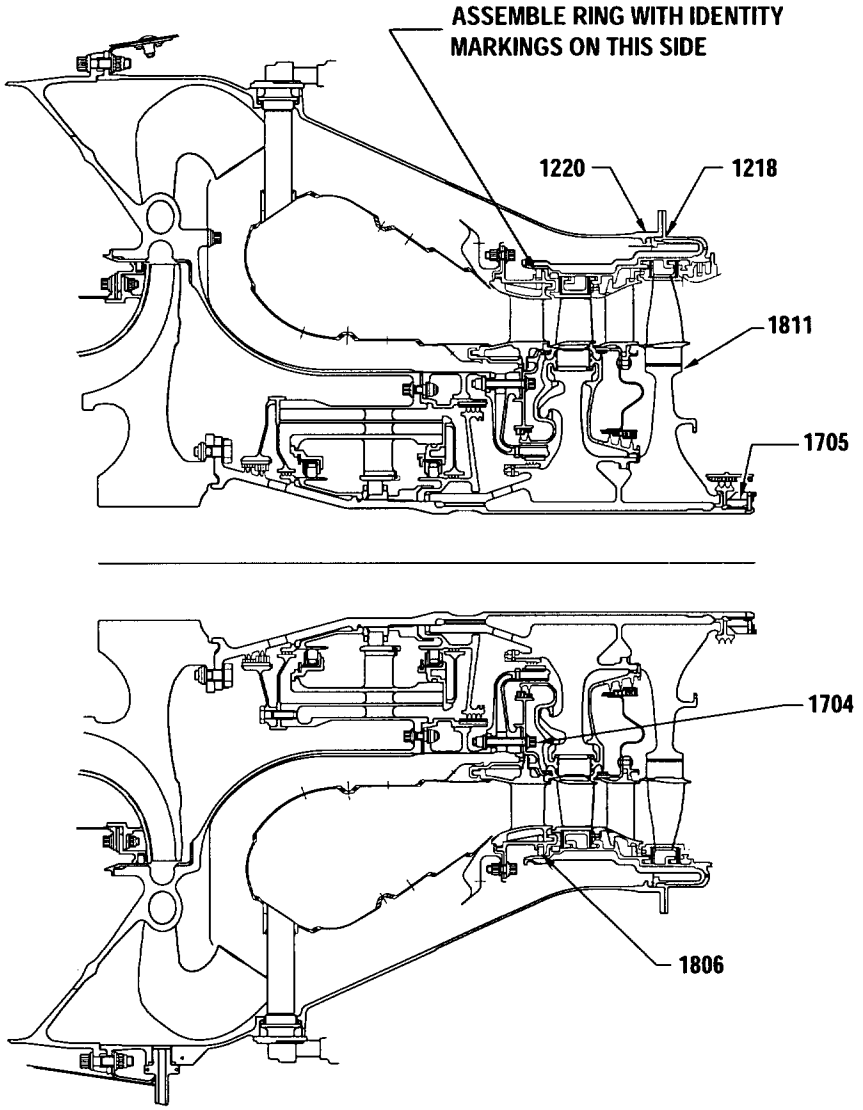
HP Turbines - Fits and Clearances
Figure 615 (Sheet 2)



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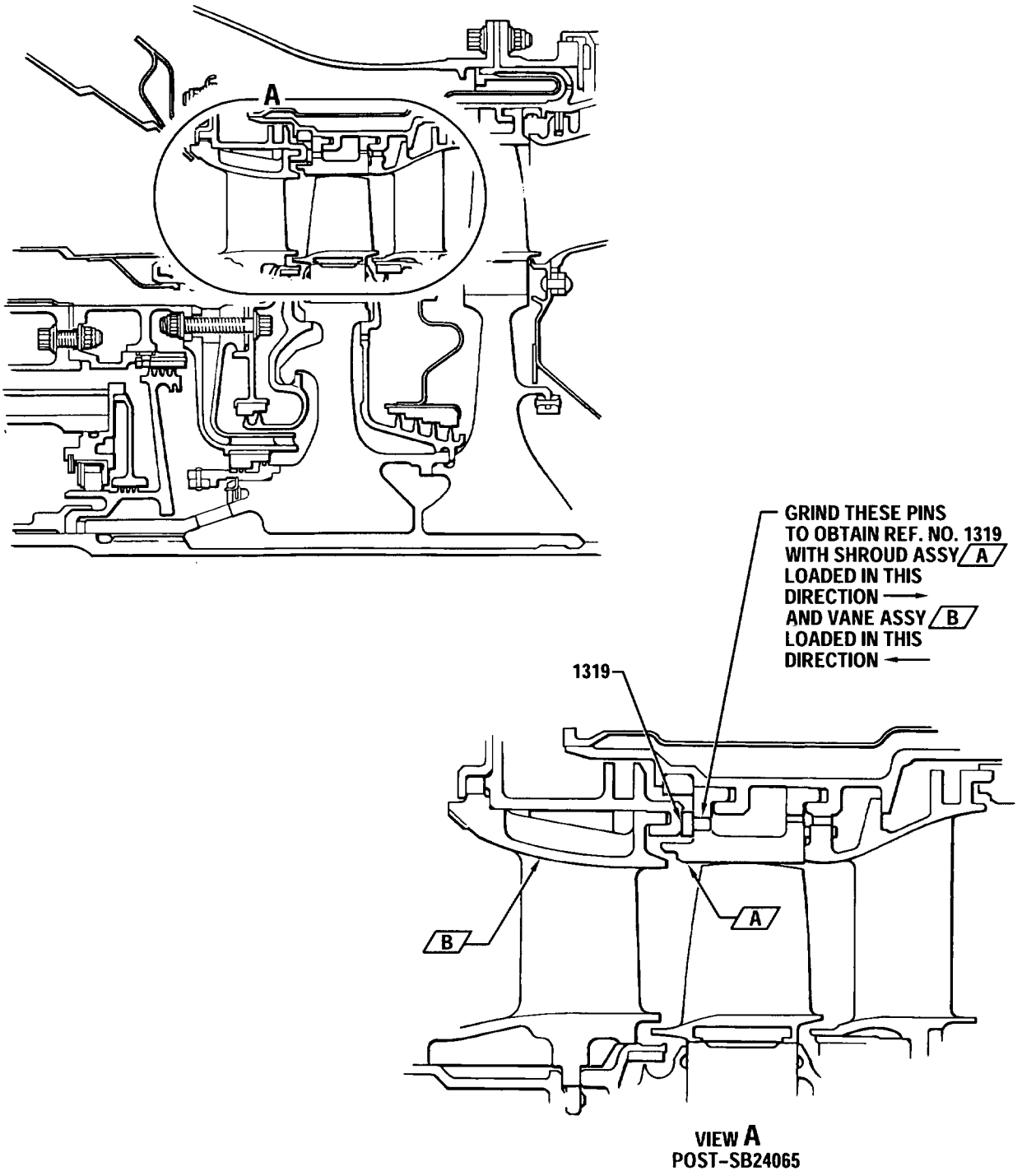
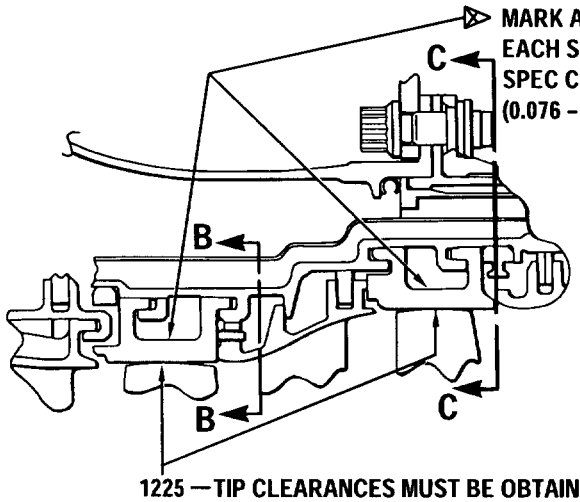
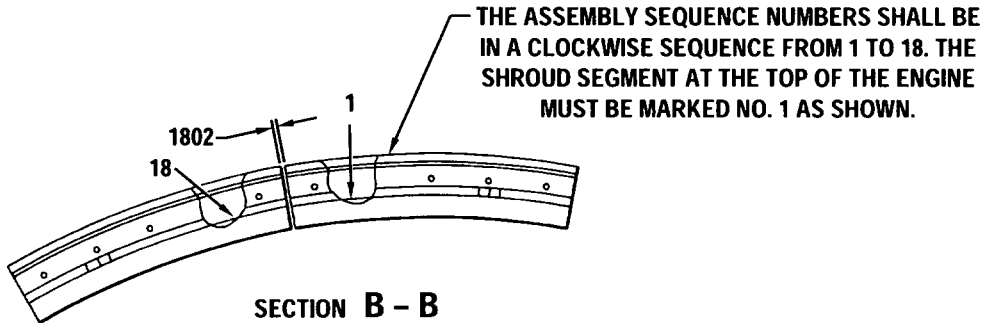
HP Turbines - Fits and Clearances
Figure 615 (Sheet 3)



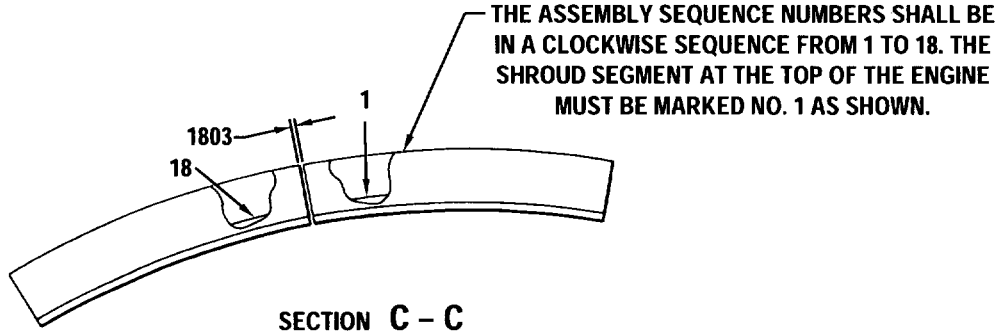
HP Turbines - Fits and Clearances
Figure 615 (Sheet 4)


MARK ASSEMBLY SEQUENCE NUMBERS 1 TO 18 ON EACH SHROUD SEGMENT BEFORE FINAL GRINDING PER SPEC CPW 10 CLASS 2. EXCEPT DEPTH TO BE .003 - .006 (0.076 - 0.152). CHARACTERS .125 (3.175) HIGH MIN.
C
B
B
C
1225 — TIP CLEARANCES MUST BE OBTAINED BY FITTING AND GRINDING SHROUD SEGMENTS OF REQUIRED CLASSES.

VIEW A


THE ASSEMBLY SEQUENCE NUMBERS SHALL BE IN A CLOCKWISE SEQUENCE FROM 1 TO 18. THE SHROUD SEGMENT AT THE TOP OF THE ENGINE MUST BE MARKED NO. 1 AS SHOWN.
1
1802
18

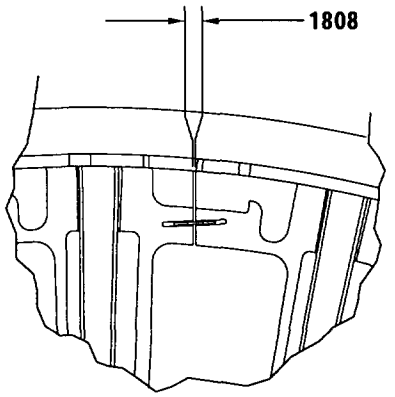
SECTION B - B


THE ASSEMBLY SEQUENCE NUMBERS SHALL BE IN A CLOCKWISE SEQUENCE FROM 1 TO 18. THE SHROUD SEGMENT AT THE TOP OF THE ENGINE MUST BE MARKED NO. 1 AS SHOWN.
1
1803
18

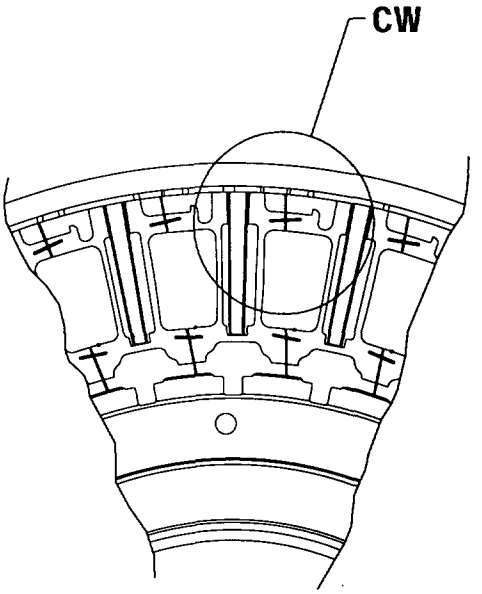
SECTION C - C

C18679A

HP Turbines - Fits and Clearances
Figure 615 (Sheet 5)



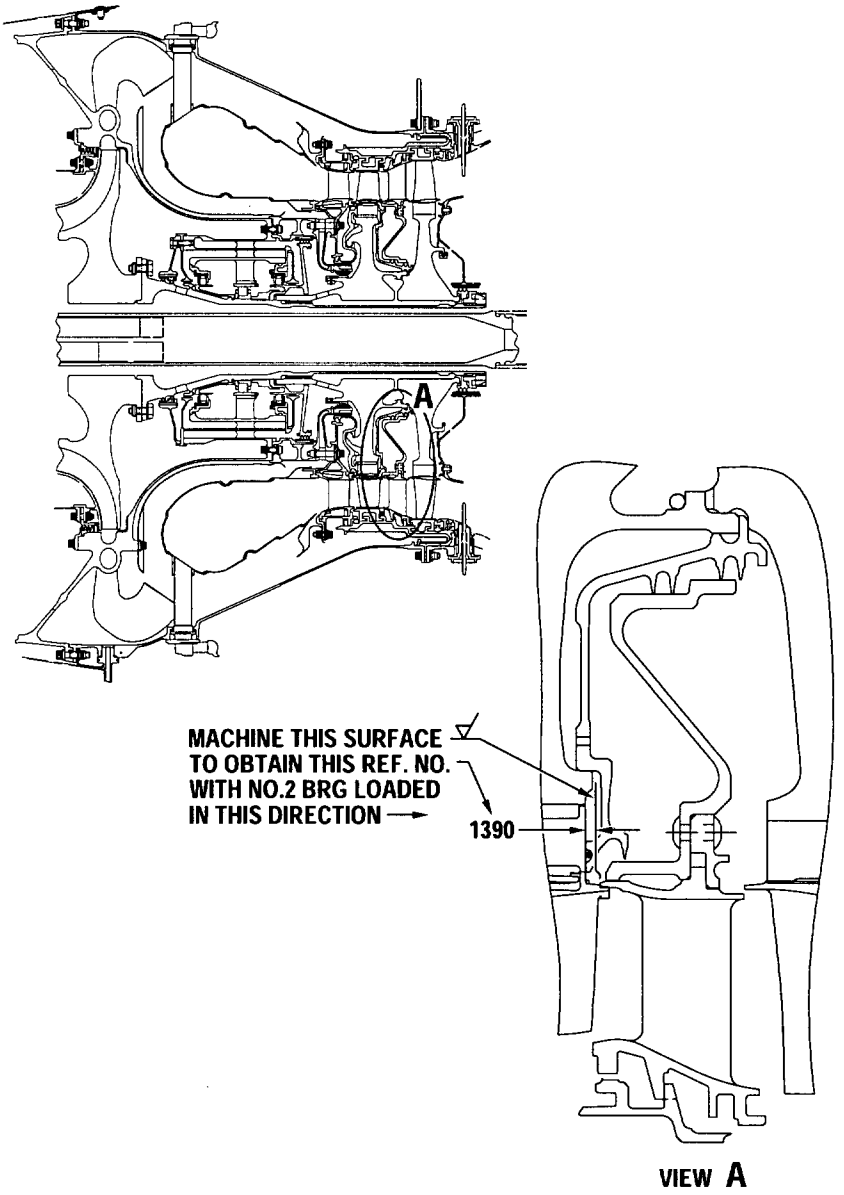
VIEW CW
TYP 32 PLACES



SECTION CV-CV

C32740B

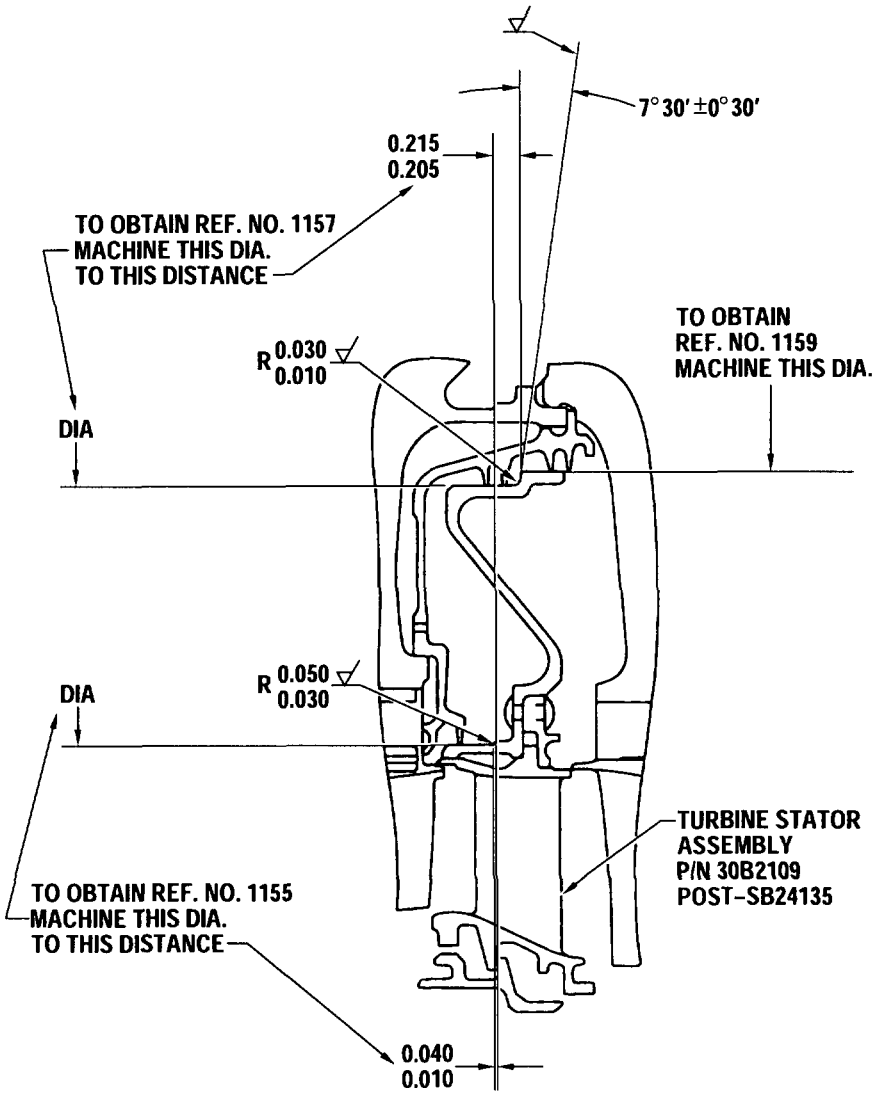
HP Turbines - Fits and Clearances
Figure 615 (Sheet 6)



Post-SB24419

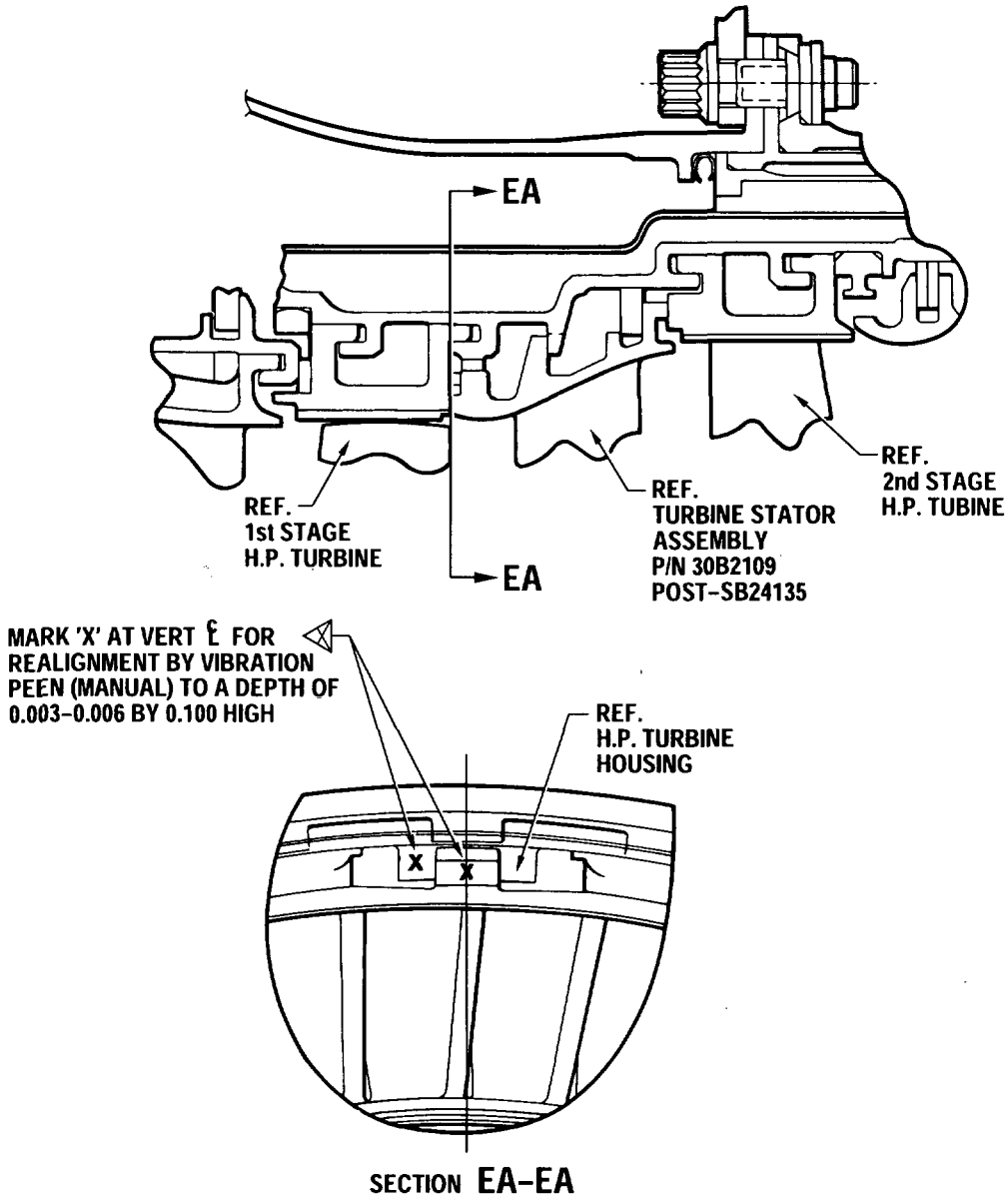
C38000

HP Turbines - Fits and Clearances
Figure 615 (Sheet 7)



Post-SB24135 C29508

HP Turbines - Fits and Clearances
Figure 615 (Sheet 8)



Post-SB24135

C29509

HP Turbines - Fits and Clearances
Figure 615 (Sheet 9)

LP TURBINE MODULE - REMOVAL/INSTALLATION

1. General

   A. The following section describes the removal and installation of the No. 4 bearing, LP turbine module and related parts.

   B. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   C. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC01-001	Fuel, Engine
PWC03-001	Oil, Engine Lubricating
PWC08-014	Adhesive, Industrial

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name	Application
PWC32505	DELETED	Replaced by PWC71392
PWC32506	DELETED	Replaced by PWC89837
PWC32550	Adapter	Obsolete - replaced by PWC41150
PWC37807	Pump	
PWC40700	Adapter	Replaces PWC43268
PWC41050	Wrench	
PWC41150	Adapter	Alternate to PWC32550
PWC43013	Base	
PWC43250	Protector	
PWC43263	Puller	Alternatively use Puller PWC60765
PWC43265	Socket	
PWC43266	Adapter, Anti-rotation	
PWC43267	Puller	
PWC43268	DELETED	Replaced by PWC40700
PWC43270	Puller	
PWC43271	Pusher	

Tool No.	Name	Application
PWC43272	Puller	
PWC43273	Puller	
PWC43274	Pad	
PWC60761	Fixture	Replaces PWC43012
PWC60764	Drift	
PWC60765	Puller	Alternatively use Puller PWC43263
PWC71392	Adapter	Replaces PWC32505
PWC89837	Cylinder	Replaces PWC32506

4. Fixtures, Equipment and Supplier Tools

Not Applicable

5. No. 4 Bearing and Related Parts

A. Removal (Ref. Fig. 401)

(1) Remove retaining ring (1) and keywasher (2).

(2) Remove LP shaft rear plug (3) using puller (PWC43263) or (PWC60765).

(3) Remove and discard preformed packings (4).

(4) Soak No. 4 bearing retaining nut (5) with a 50/50 mixture of engine oil (PWC03-001) and fuel (PWC01-001) .

(5) Install adapter (PWC43266) into slots at end of LP shaft.

(6) Slide socket (PWC43265) over adapter and engage lugs with slots in No. 4 bearing retaining nut (5).

(7) Install adapter (PWC32550) or (PWC41150) on power wrench (PWC41050).

CAUTION: DO NOT EXCEED 11200 LB. IN. ON ADAPTER (PWC43266).

(8) Install power wrench on adapter and socket and remove No. 4 bearing retaining nut.

(9) Loosen jaws of puller (PWC43267) and locate on front face of No. 4 bearing inner race (7). Secure jaws in place. Turn center bolt of puller to position pad on LP shaft.

CAUTION: WEAR CLEAN LINT FREE GLOVES WHEN HANDLING BEARINGS.

(10) Remove No. 4 bearing (7) and No. 4 bearing retaining ring (6) together using puller (PWC43267)). Put bearing in a suitable clean container.

(11) Remove flanged sleeve spacer (8) using puller (PWC43273).

(12) Remove No. 4 bearing air seal (9) using puller (PWC43270).

B. Installation (Ref. Fig. 401)

CAUTION: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(1) Heat No. 4 bearing air seal (9) in oven at 204°C (400°F) for a 10 to 15 minutes.

CAUTION: DO NOT EXCEED MAXIMUM HYDRAULIC PRESSURE OF 1050 PSIG (7.2 kPa).

(2) Install No. 4 bearing air seal (9) with adapter (PWC40700), pusher (PWC43271), cylinder (PWC89837), and pump (PWC37807). Maximum cylinder pressure 950 to 1050 PSI. Maintain cylinder pressure until temperatures equalize. Remove tooling.

NOTE: Refer to Figure 401 for correct air seal orientation.

CAUTION: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(3) Heat No. 4 bearing sleeve spacer (8) in oven at 204°C (400°F) for a minimum of 15 minutes.

CAUTION: DO NOT EXCEED MAXIMUM HYDRAULIC PUMP PRESSURE OF 1050 PSIG (7.2 kPa).

(4) Install sleeve spacer (8) with cylinder (PWC89837), pump (PWC37807), adapter (PWC40700) and pusher (PWC43271). Maintain cylinder pressure until temperatures equalize. Remove tooling.

NOTE: Refer to Figure 401 for correct sleeve spacer orientation.

CAUTION: WEAR CLEAN, LINT FREE GLOVES WHEN HANDLING BEARING.

(5) Heat No. 4 bearing (7) in oil at 121°C (250°F) for a minimum of 15 minutes.

CAUTION: MAKE SURE BEARING IS INSTALLED WITH SERIAL NUMBER FACING FORWARD.

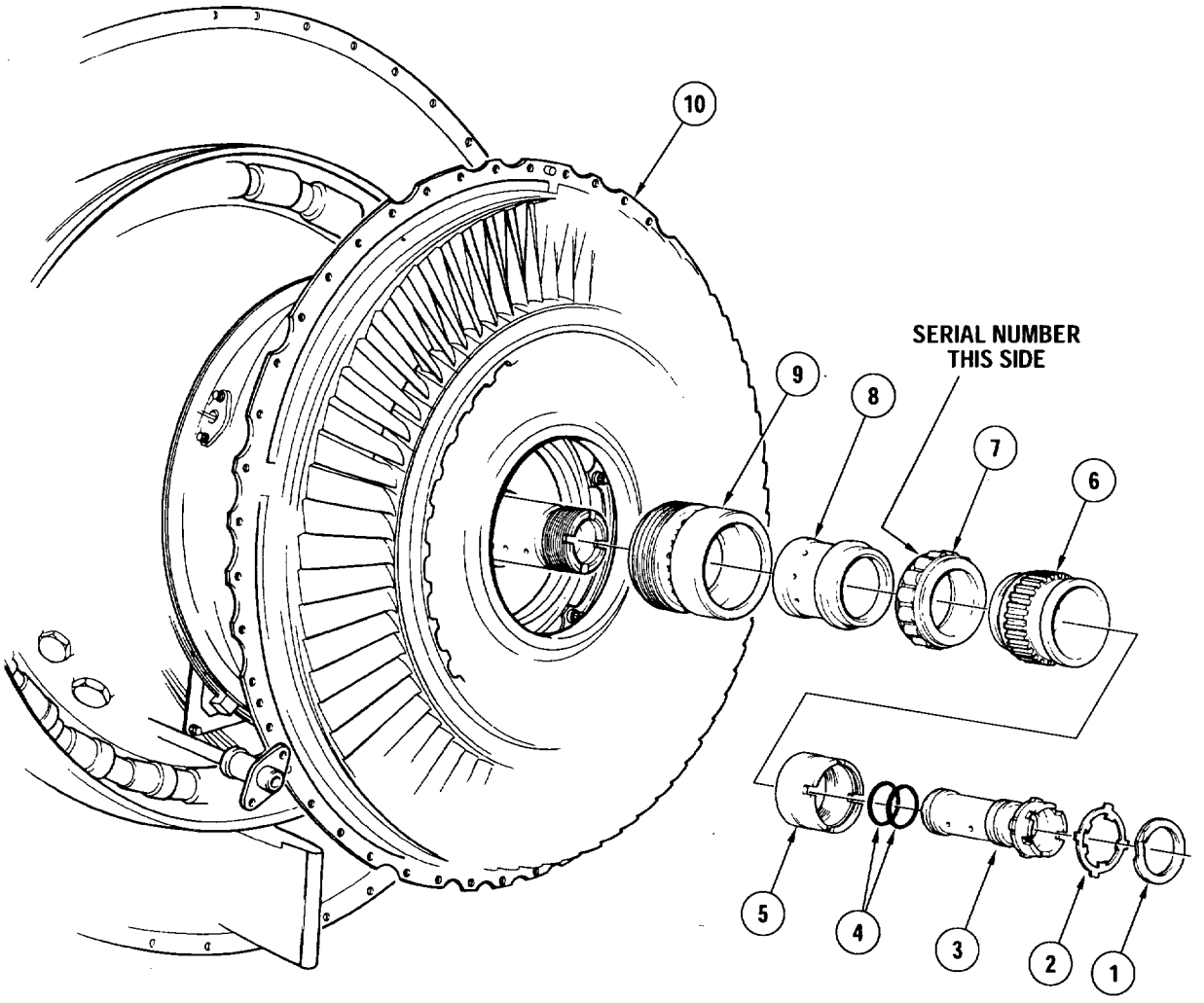
CAUTION: DO NOT EXCEED MAXIMUM HYDRAULIC PRESSURE OF 1050 PSIG (7.2 kPa).

(6) Install No. 4 bearing (7) with cylinder (PWC89837), pump (PWC37807), adapter (PWC40700) and pusher (PWC43271). Pressurize cylinder 950 to 1050 psi (6550 to 7239 kPa). Maintain cylinder pressure until temperatures equalize. Remove tooling.

NOTE: Refer to Figure 401 for correct bearing orientation.

CAUTION: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(7) Heat fuel shut off phonic ring (6) in oven at 204°C (400°F) for 10 to 15 minutes.



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Removal/Installation of No. 4 Bearing and Related Parts
Figure 401

Key to Figure 401

1. Retaining Ring
2. Keywasher
3. LP Shaft Rear Plug
4. Preformed Packing
5. Retaining Nut
6. Fuel Shut-off Phonic Ring
7. No. 4 Bearing
8. Flanged sleeve spacer
9. No. 4 Bearing Air Seal
10. LP Turbine Module

CAUTION: DO NOT EXCEED MAXIMUM HYDRAULIC PRESSURE OF 1050 PSIG (7.2 kPa).

(8) Install phonic ring (6) with cylinder (PWC89837), pump (PWC37807) and adapter (PWC40700) and pusher (PWC43271). Pressurize cylinder 950 to 1050 PSI.

(9) Maintain cylinder pressure and allow low compressor shaft to cool to room temperature.

(10) Remove tooling from LP shaft.

(11) Lubricate threads on low compressor shaft and retaining nut (5) with engine oil (PWC03-001).

(12) Install retaining nut (5) and torque (Fits and Clearances, REF. NO. 1706) using adapter (PWC43266), socket (PWC43265), adapter (PWC32550) or (PWC41150), wrench (PWC41050).

CAUTION: DO NOT FORCE KEY WASHER INTO SLOTS. IF KEY WASHER DOES NOT ALIGN, REMOVE PLUG AND REINSTALL IN A DIFFERENT POSITION OR REINSTALL RETAINING NUT.

(13) Fit plug (3) in LP compressor shaft, without packings, to determine the correct locking position of key washer (2). Fit keywasher (2). Mark locking position on key washer, plug and nut using an approved marker. Remove keywasher and plug.

(14) Lubricate and install two new preformed packings (4) on plug (3).

(15) Install plug (3) in low compressor shaft with drift (PWC60764).

(16) Install keywasher (2) and retaining ring (1).

6. LP Turbine Module

CAUTION: DO NOT ROTATE ENGINE MORE THAN 10 DEGREES FROM HORIZONTAL POSITION.

A. Removal (Ref. Fig. 402)

(1) Remove exhaust case assembly (Ref. 72-50-03).

(2) Mark the position of all brackets on flange E using an approved marker.

(3) Disconnect and remove T4.5 wiring harness connections from N1/T4.5 terminal box (Ref. 77-20-01).

(4) Remove clamps securing T4.5 wiring harness to N1 wiring harness (Ref. 77-20-01).

(5) Install pad (8) (PWC43274) on LP shaft (11).

(6) Position split-body (9) of puller (PWC43272) over ID of fourth-stage LP turbine (12) disk. Install sleeve (10) of puller over split-body (9).

(7) Attach lifting fixture (2) to Flange F of LP module using four 5/16 bolts. Adjust hoist to support the weight of the LP module.

(8) Position split-body (4) of lifting fixture (2) on fourth-stage LP turbine disk (12), and secure body in position with cap screws.

(9) Insert sleeve (5) of lifting fixture (2) into position inside split-body, and secure with cap screws.

(10) Screw cylinder (7) (PWC89837) into adapter (6).

(11) Install adapter (6) (PWC71392) on puller (PWC43272). Make sure lever of adapter aligns with the word "LOCK" on puller.

(12) Connect pump (3) (PWC37807) to cylinder (7).

(13) Remove remaining bolts (13) from Flange E.

(14) Install four jacking screws in flange E.

(15) Remove LP turbine module (1) by simultaneously applying pressure to puller and turning jacking screws.

(16) Remove pump (3), cylinder (7), puller (PWC43272) and pad (8) from LP turbine module (1).

(17) Remove metal seal rings from third-stage turbine vane assembly.

(18) Put LP turbine module on holding base (PWC43013).

(19) Install protector (PWC43250) on LP shaft.

B. Installation (Ref. Fig. 403)

(1) Attach lifting fixture (PWC60761) to LP turbine module. Lift LP module off base.

(2) Make sure seal rings (10) (Ref. Section A-A) are correctly installed in third-stage vane of LP module, with gaps 180 degrees apart.

(3) Heat center of fourth-stage LP turbine disk for a minimum of 30 minutes with suitable heat guns.

(4) Remove protector from LP compressor shaft.

(5) Align shoulder pin on LP turbine module (1) with top center of engine, and engage splines on fourth-stage rotor with LP compressor shaft.

CAUTION: MAXIMUM HYDRAULIC PUMP PRESSURE IS 2200 PSIG (15,169 kPa).

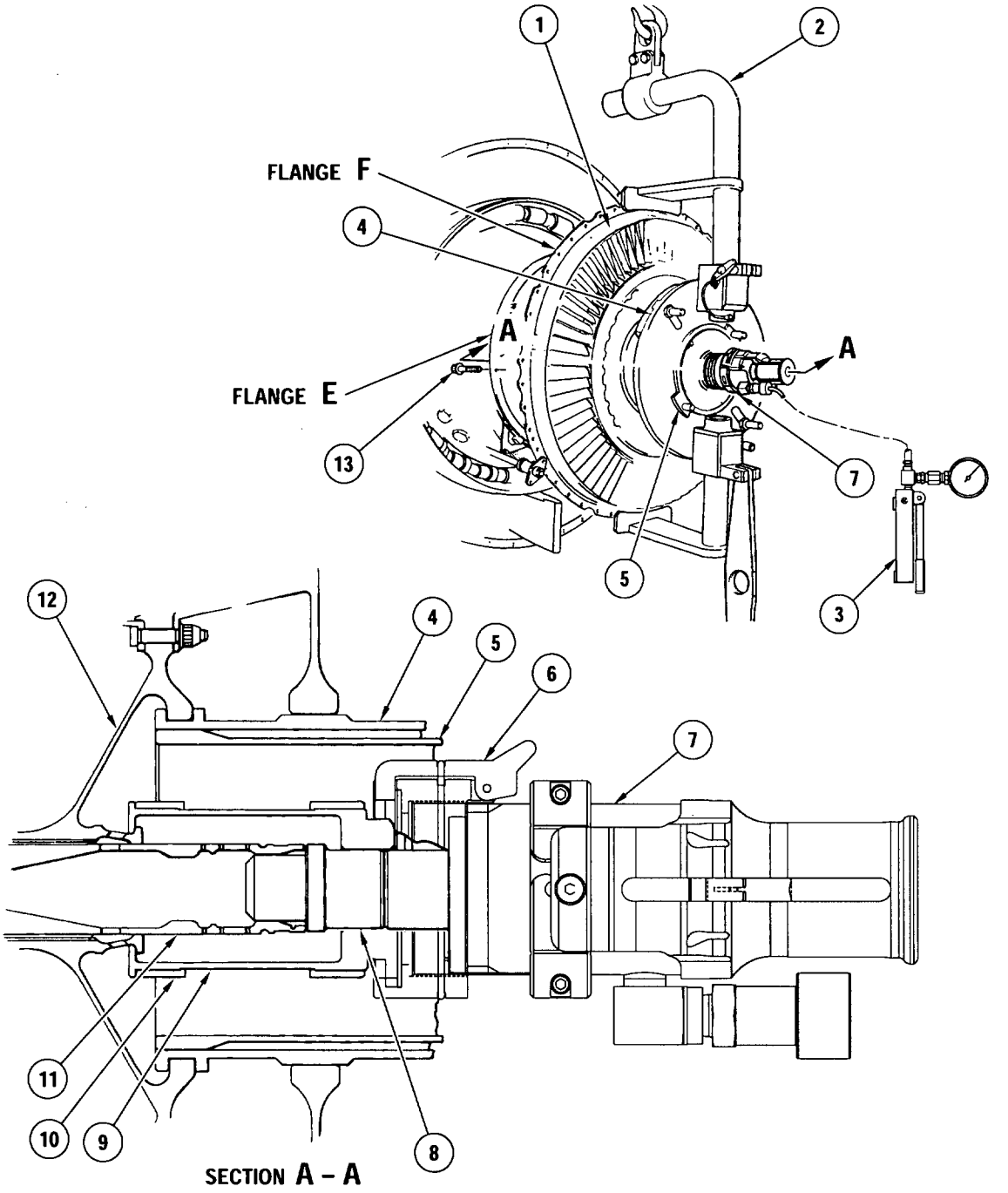
(6) Install LP turbine module (1) with cylinder (PWC89837), pump (PWC37807), adapter (PWC40700) and pusher (PWC43271). Maintain pump pressure until temperatures have equalized.

(7) Install 23 bolts (7) and brackets (2, 3, 4, 5 and 6) at positions marked during removal. (Ref. Sheet 2). Torque 85 to 95 lb.in. (9.7 to 10.7 Nm).

NOTE: Do not install bolts at Locations D. Bolts and brackets at these locations are installed with T4.5 wiring harness (Ref. 77-20-01).

(8) Install three bolts (9) and bracket (8) at Location B. Torque 85 to 95 lb. in. (9.7 to 10.7 Nm).

(9) Install T4.5 harness (Ref. 77-20-01).



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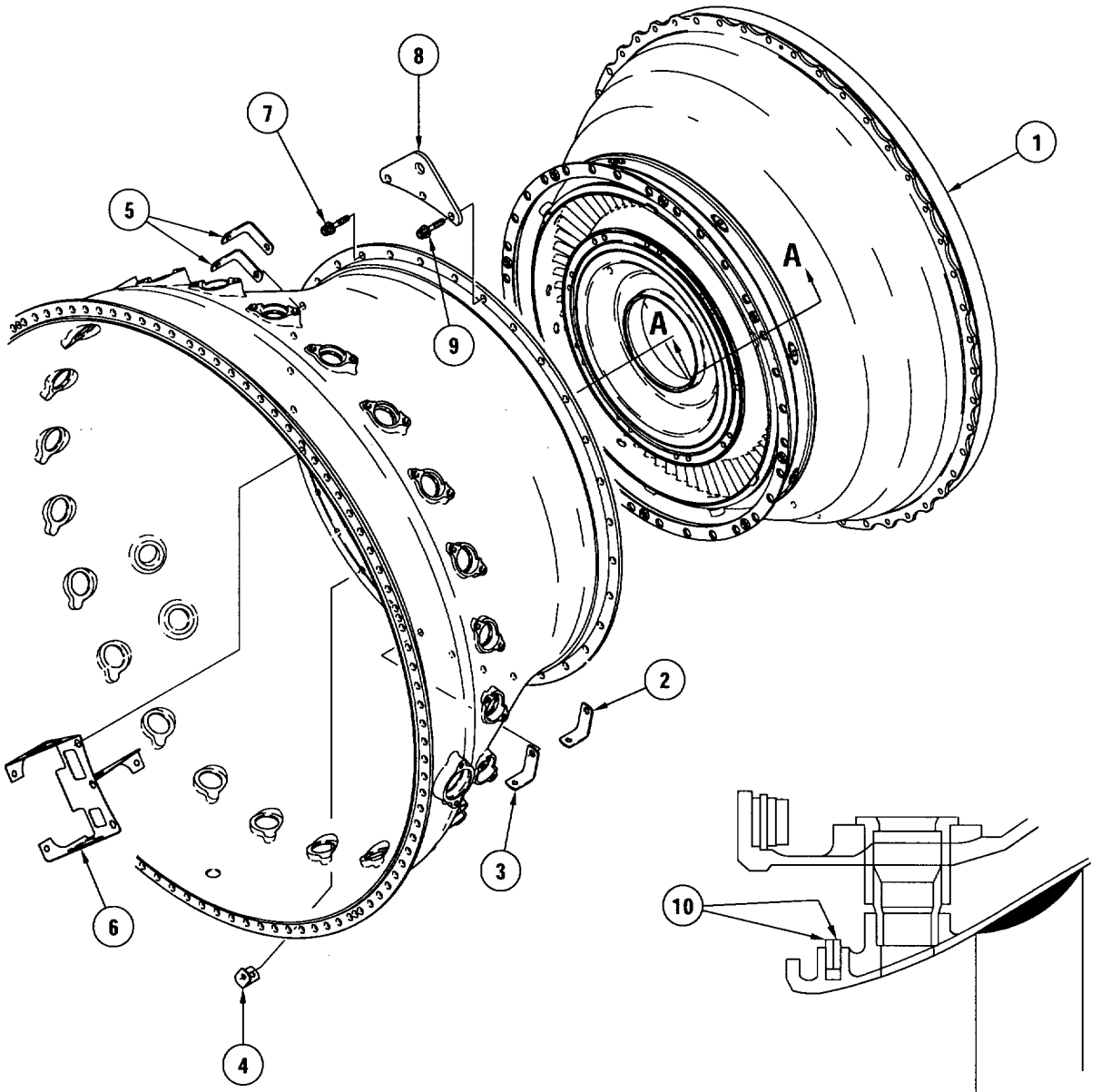
Removal of LP Turbine Module
Figure 402

Key to Figure 402

1. LP Turbine Module
2. Lifting Fixture (PWC60761)
3. Pump
4. Split Body (part of lifting fixture)
5. Sleeve (part of lifting fixture)
6. Adapter (PWC71392)
7. Cylinder (PWC89837)
8. Pad
9. Split Body (part of puller)
10. Sleeve (part of puller)
11. LP Shaft
12. Fourth-stage LP Turbine Disk
13. Bolt (Flange E)



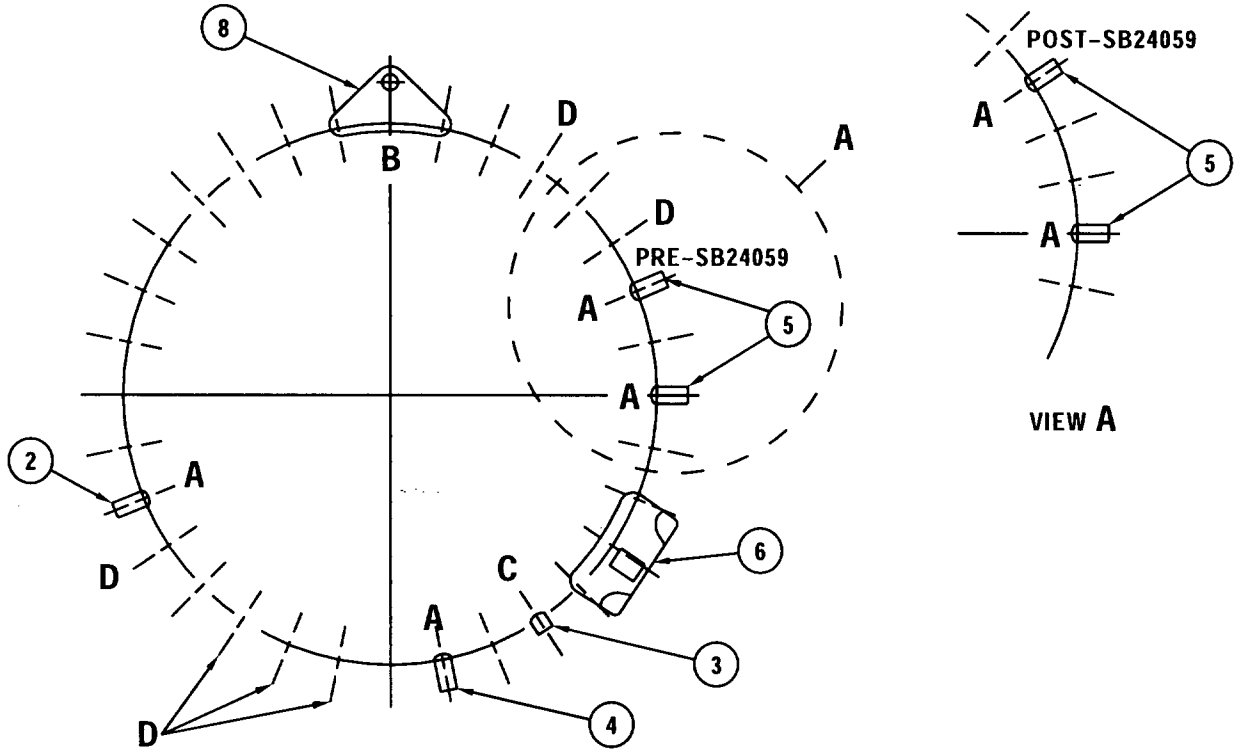
SECTION A-A

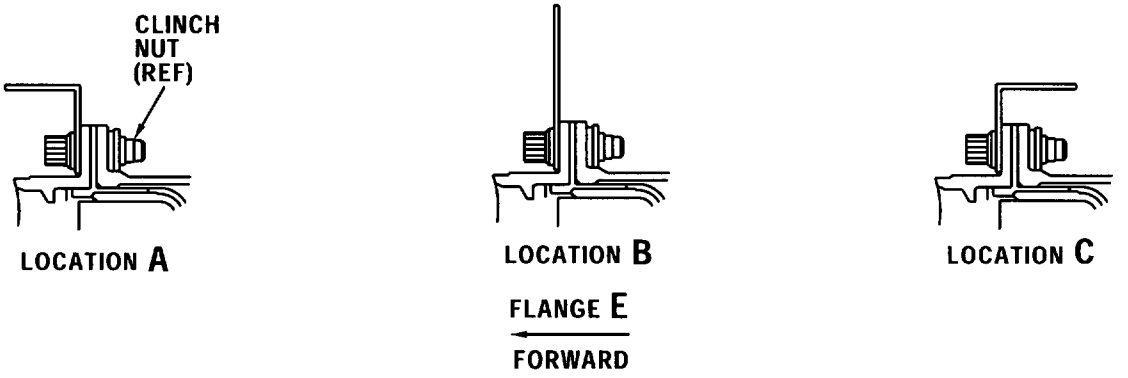
C31471

Installation of LP Turbine Module
Figure 403 (Sheet 1 of 2)

Key to Figure 403

1. LP Turbine Module
2. Bracket
3. Bracket
4. Bracket
5. Bracket
6. Mount Bracket
7. Bolt
8. Lifting Bracket
9. Bolt
10. Seal Ring





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Installation of LP Turbine Module
Figure 403 (Sheet 2)

LP TURBINE MODULE - INSPECTION/CHECK

1. General

   A. This section provides instructions and limits for inspection/check of the LP Turbines, Stators and Case.

   B. It is recommended that a magnifying glass of at least 10X power be used when visually inspecting for damage.

   C. Within the following text, where the term nicks or dents is used, unless otherwise specified, blend repair limits are applicable provided at least 70 percent of original surface remains undamaged.

   D. Parts found unsuitable for further engine running should be replaced. Rejected parts should be returned to Pratt & Whitney Canada for complete inspection and possible repair/refurbishment.

2. Consumable Materials

   Not Applicable

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. LP Turbine Case (Ref. Fig. 601)

   A. Visual Check

      (1) Inspect for cracks. Reject if evident.

      (2) Inspect for nicks or dents. Acceptable, with blending, to a maximum depth of 0.030 inch (0.8 mm).

      (3) Inspect for evidence of isolated heat spots. Reject if evident.

      (4) Inspect for deformation of front and rear flanges. Reject if evident.

      (5) Inspect clinch nuts for thread damage. Replace as necessary (Ref. 70-00-00, REPAIR).

6. LP Turbine Seal Rings

   A. Visual Checks

      (1) Check Faces for:

         (a) Nick, dents, raised metal and sharp edges. Stone to remove raised material.

(2) Check Sealing diameter for:

(a) Raised metal or sharp edges. Stone to remove.

(3) Visually check all other surfaces for:

(a) Check local surface damage, wear or fretting. Acceptable to 0.005 inch deep.

(b) Install seal ring in housing assembly. Check that gap between components does not exceed 0.002 inch over 20 percent of circumference.

7. Third-stage Vane Assembly (Ref. Fig. 601)

A. Visual Check

(1) Cracks in the vane ring outer shroud are acceptable within the following limits:

(a) Any number of cracks in the outer shroud (including horse shoe cracks) up to 0.200 inch (5.1 mm) in length.

(b) Cracks originating at the front or rear edge of the shroud and not entering the airfoil root radii. Eight cracks up to maximum length of 0.300 inch (7.6 mm) are permitted per vane ring providing:

1 There is no more than one crack between two air foils.

2 The width of open cracks does not exceed 0.010 inch (0.25 mm).

3 The cracks are not converging.

(c) Up to 12 cracks per vane ring around airfoil root radii (horse shoe cracks) up to maximum length of 0.300 inch (7.6 mm).

(d) Cracks around location bosses (Ref. Area A10) are acceptable within the following limits:

1 Cracks up to 0.200 inch (5.1 mm) total length per boss.

2 Cracks up to 0.300 inch (7.6 mm) total length per boss, at a maximum of three bosses.

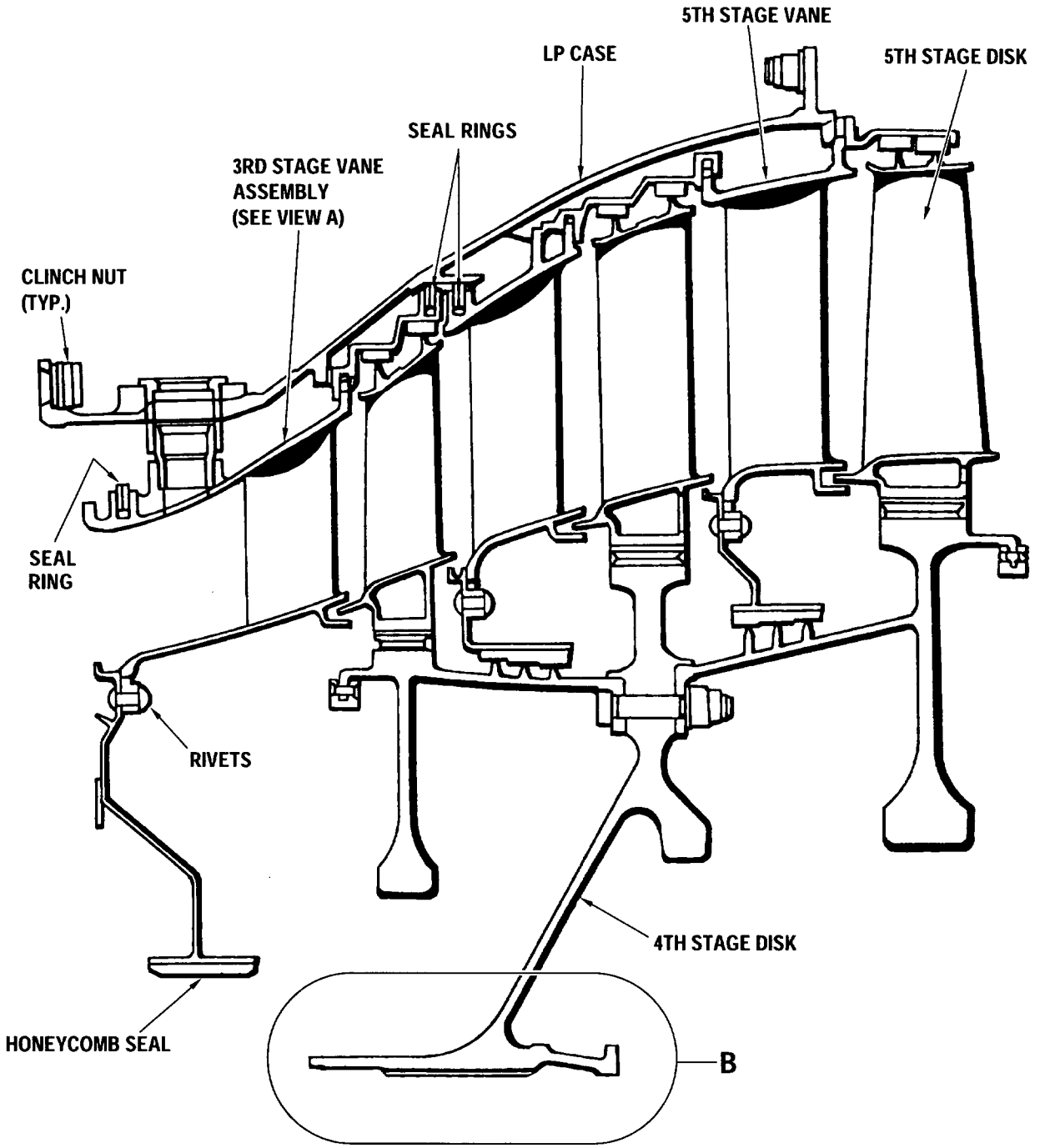
3 At one location boss only, one crack up to 1.000 inch (25.4 mm) is acceptable providing:

a The width of the crack is less than 0.015 inch (0.4 mm).

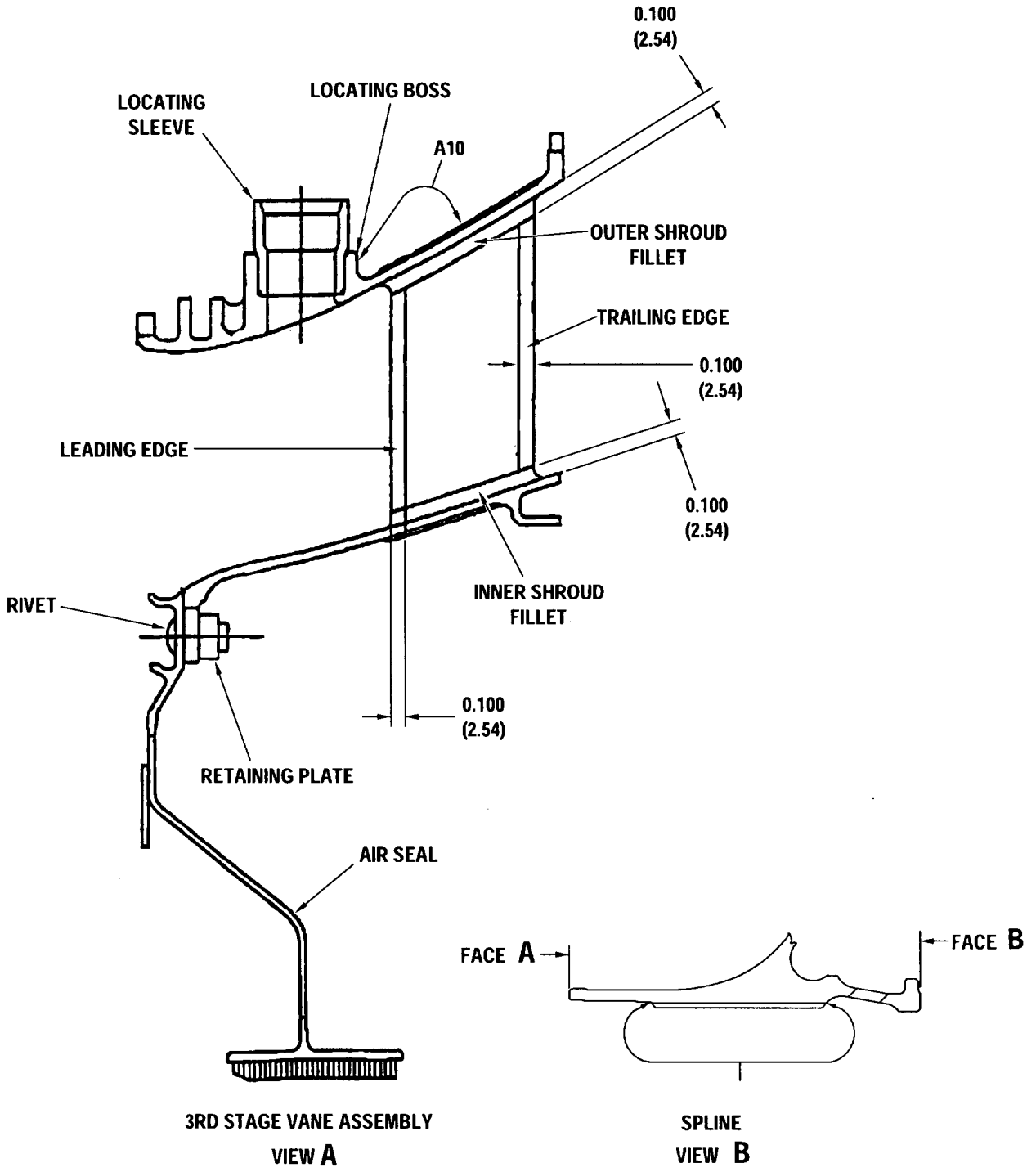
b The misalignment of the crack edges is less than 0.020 inch (0.5 mm).

c A borescope inspection of the area is performed at 400 hours intervals.

(2) Cracks in the vane ring inner shroud are acceptable within the following limits:



LP Turbine Case, Rotors and Stators
Figure 601 (Sheet 1 of 4)



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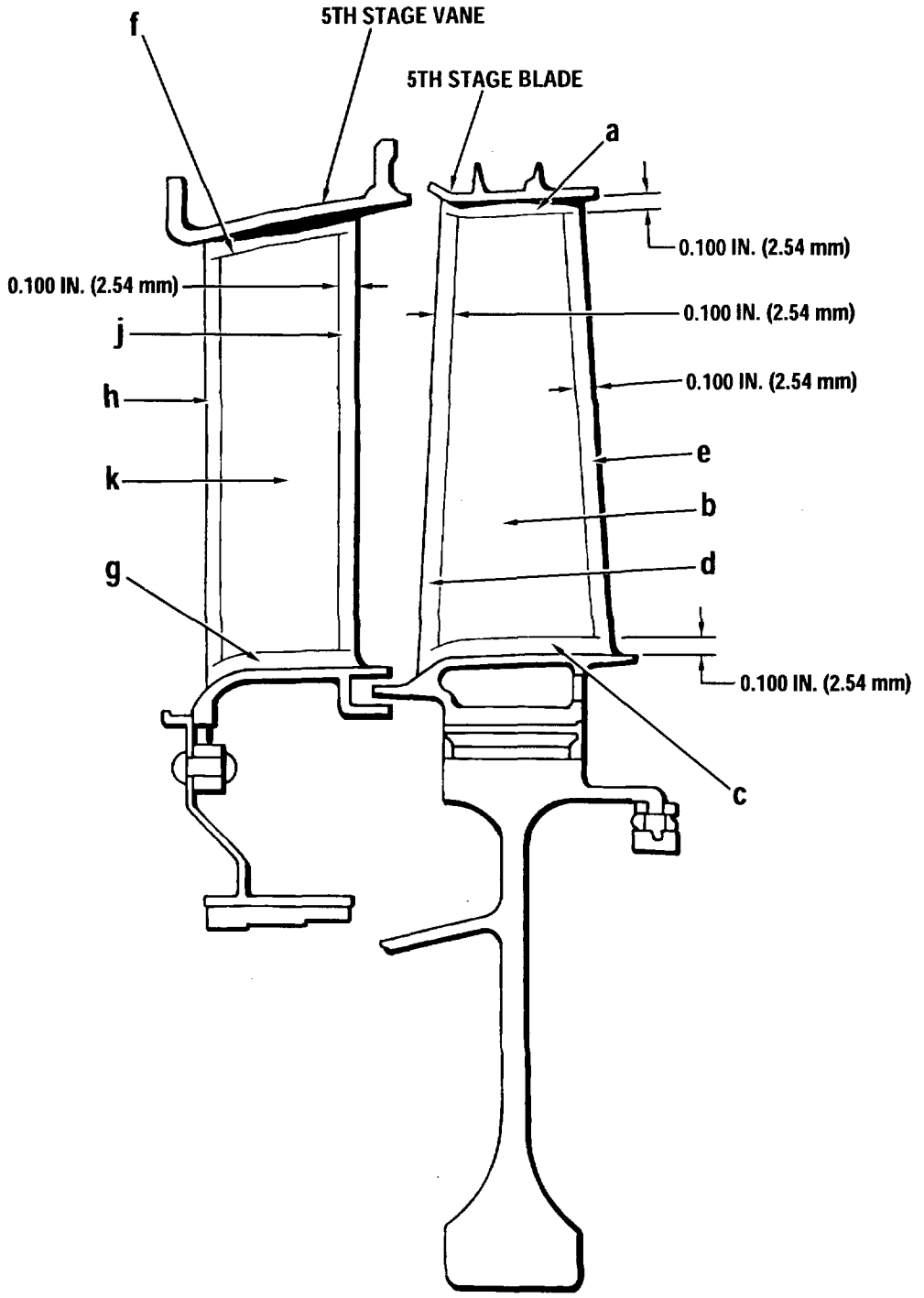
LP Turbine Case, Rotors and Stators
Figure 601 (Sheet 2)



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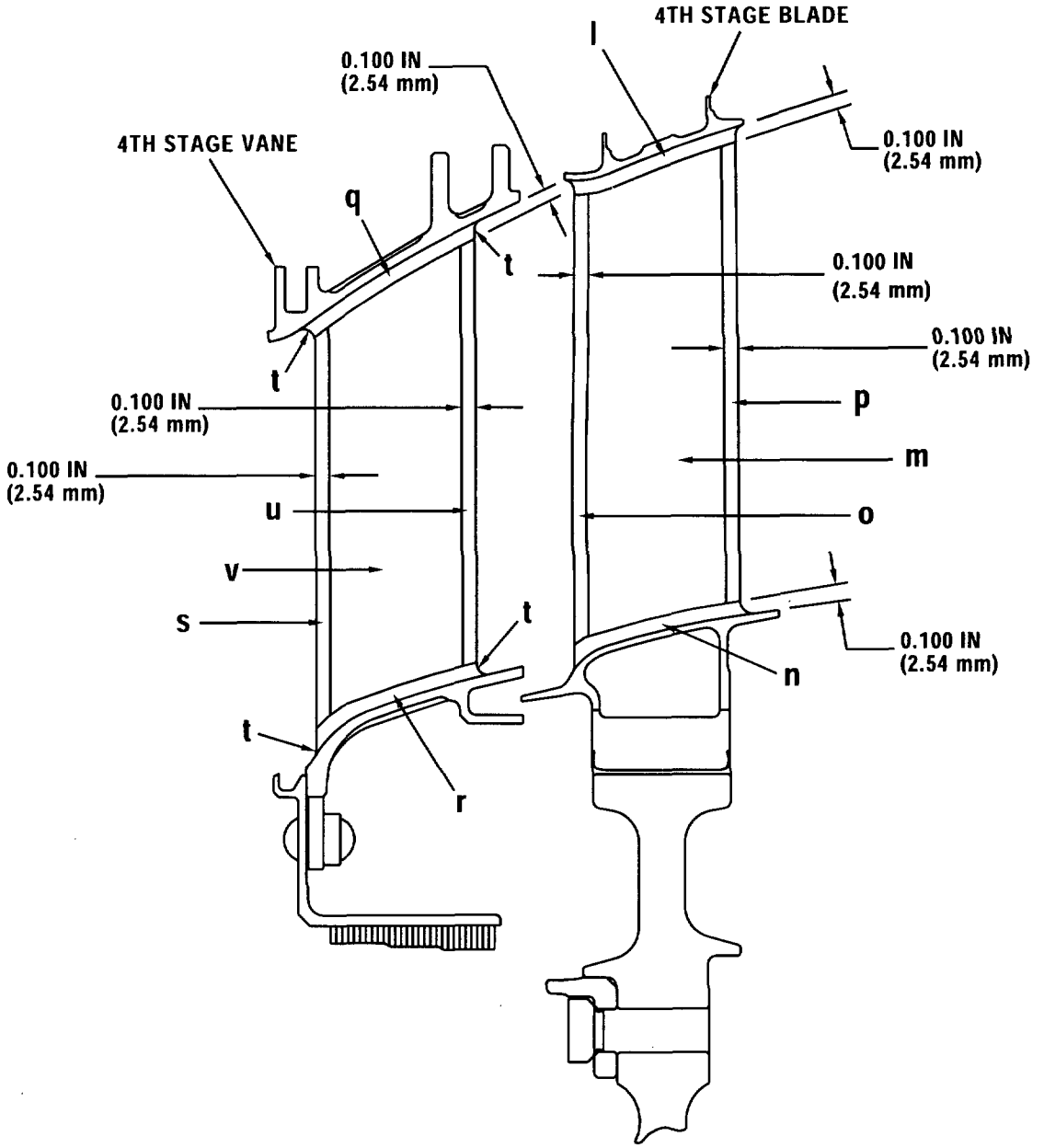
LP Turbine Case, Rotors and Stators
Figure 601 (Sheet 3)



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LP Turbine Case, Rotors and Stators
Figure 601 (Sheet 4)

(a) Any number of cracks in the inner shroud (including horse shoe cracks) up to 0.200 inch (5.1 mm) in length.

(b) Cracks originating at the rear edge of the shroud and not entering the airfoil root radii. Twelve cracks up to maximum length of 0.300 inch (7.6 mm) are permitted per vane ring providing:

1 There is no more than one crack between two air foils.

2 The width of open cracks does not exceed 0.010 inch (0.25 mm).

3 The cracks are not converging.

(c) Up to 12 cracks around airfoil root radii (horse shoe cracks) up to maximum length of 0.300 inch (7.6 mm).

(3) Cracks in the leading edge of vane ring air foils are acceptable within the following limits:

(a) Any number of cracks up to 0.120 inch (3.0 mm) in length provided width of open cracks does not exceed 0.010 inch (0.25 mm).

(b) The cracks are not converging.

(4) Cracks in the trailing edge of vane ring air foils are acceptable within the following limits:

(a) Any number of cracks up to 0.200 inch (5.1 mm) in length provided width of open cracks does not exceed 0.010 inch (0.25 mm).

(b) One crack per airfoil up to 0.300 inch (7.6 mm) in length provided width of open cracks does not exceed 0.010 inch (0.25 mm).

(c) The cracks are not converging.

(5) Cracks in the fillet radii at the airfoil leading and trailing edge of the vane ring (crack length is the total length on surface) are acceptable within the following limits:

(a) Any number of cracks up to 0.200 inch (5.1 mm) in length.

(b) Up to 12 cracks per vane ring up to maximum length of 0.350 inch (8.9 mm).

(6) Reject vane if any other area of the vane ring has cracks.

(7) Reject the air seal if it is cracked.

(8) Inspect for nicks or dents. Acceptable, with blending, to a maximum depth of 0.060 inch (1.5 mm).

(9) Inspect for coating loss, reject if any coating loss evident.

(10) Inspect for sulfidation, reject if any evidence of sulfidation.

(11) Inspect for honeycomb seal cell disbonding, acceptable provided:

(a) No more than 20 adjacent cells disbonded.

(b) No more than three rows of cells damaged to a maximum length of 0.800 inch (20.3 mm).

(12) Inspect for loose or damaged seal retaining rivets. Replace as necessary.

8. Fourth-stage Disk, Blades and Vanes (Ref. Fig. 601)

A. Visual Check of Fourth-stage Disk Hub

(1) Inspect for cracks. Reject if evident.

(2) Inspect for evidence of damage to internal spline as follows:

(a) Indentations on involute surface. Damage is acceptable to 0.002 inch deep.

(b) Improper tooth contact pattern, pitting, spalling, chipping or wear. Reject if evident.

(3) Inspect for nicks or dents. Reject if evident.

(4) Inspect for evidence of fretting on Faces A and/or B. Reject if evident.

B. Inspect Fourth-stage Blades and Vanes Using Borescope (Ref. Table 601 and Fig. 601, Sheet 4)

(1) Place LP rotor and stator assembly on bench to gain access through fifth-stage blade and vane areas.

(2) Insert borescope probe through fifth-stage blade and vane areas until fourth-stage blade and vanes are visible.

(3) Inspect fourth-stage blade and vanes at 12 locations around the assembly.

(4) Cracks other than in Table 601 are unacceptable. Reject assembly if evident.

(5) Inspect for sulfidation. Reject if evident.

NOTE: Sulfidation appears as a greenish to pale blue color.

TABLE 601, Fourth-stage Blade and Vane Inspection

Inspection	Acceptable Limits	Acceptable Repair
Area l for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.005 inch (0.13 mm).	Blend.
Area m for:		

TABLE 601, Fourth-stage Blade and Vane Inspection (Cont'd)

Inspection	Acceptable Limits	Acceptable Repair
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.010 inch (0.25 mm).	Blend.
Area n for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.005 inch (0.13 mm).	Blend.
Area o for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.010 inch (0.25 mm).	Blend.
Area p for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.010 inch (0.25 mm).	Blend.
Bends	One bend, maximum deflection 0.015 inch (0.38 mm), maximum length 25 percent of trailing edge.	Not repairable (Ref. NOTE).
VANES		
Area q for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.060 inch (1.5 mm).	Blend.
Area r for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.060inch (1.5 mm).	Blend.
Area s for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.060inch (1.5 mm).	Blend.
Area t for:		
Cracks	Cracks in the inner and outer radii at leading maximum length 0.120 inch (3.0 mm).	Not repairable (Ref. NOTE).
Area u for:		

TABLE 601, Fourth-stage Blade and Vane Inspection (Cont'd)

Inspection	Acceptable Limits	Acceptable Repair
Cracks	Hairline cracks to a maxinum length of 0.300 inch (7.6 mm) and/or open cracks maximum width 0.010 inch (0.25 mm) and maximum length of 0.200 inch (5.0 mm).	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.015 inch (0.38 mm).	
Bends	One bend, maximum deflection 0.060 inch (1.5 mm), maximum length 25 percent of trailing edge.	Not repairable (Ref. NOTE).
Area v for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
NOTE: Low pressure turbine rotor and stator assemblies exhibiting damage in excess of above limits can be returned to a Pratt & Whitney Canada Approved Overhaul Facility for possible repair and refurbishment.		

9. Fifth-stage Disk, Blades and Vanes (Ref. Fig. 601 and Table 602)

A. Visual Check of Fifth-stage Blades and Vanes

(1) Refer to Table 602.

B. Visual Check of Fifth-stage Disk

(1) Inspect for cracks. Rejects assembly if evident.

(2) Inspect for nicks or dents. Reject assembly if evident.

(3) Inspect for cracked or deformed blade retaining rivets. Reject assembly if evident.

TABLE 602, Fifth-stage Blade and Vane Inspection

Inspection	Acceptable Limits	Acceptable Repair
Area a for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.005 inch (0.13 mm).	Blend.
Area b for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.005 inch (0.13 mm).	Blend.
Area c for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.005 inch (0.13 mm).	Blend.

TABLE 602, Fifth-stage Blade and Vane Inspection (Cont'd)

Inspection	Acceptable Limits	Acceptable Repair
Area d for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.010 inch (0.25 mm).	Blend.
Area e for:		
Cracks	No cracks permitted.	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.010 inch (0.25 mm).	Blend.
Bends	One bend, maximum deflection 0.015 inch (0.38 mm maximum) length 25 percent of trailing edge.	Not repairable (Ref. NOTE).
VANES		
Areas f, g, and h		
	Not visible for inspection; requires complete strip of LP module at an Overhaul facility.	N/A
Area j for:		
Cracks	Hairline cracks to a maximum length of 0.300 inch (7.6 mm) and/or open cracks to a maximum length of 0.200 inch (5.0 mm) and maximum width 0.010 inch (0.25 mm).	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.060 inch (1.52 mm).	Blend.
Bends	One bend, maximum deflection 0.060 inch (1.52 mm) maximum length 25 percent oftrailing edge.	Not repairable (Ref. NOTE).
Area k for:		
Cracks	Cracks extending from Area j are permitted, all other surface cracks, maximum length 0.020 inch (0.51 mm).	Not repairable (Ref. NOTE).
Nicks or dents	Maximum depth 0.020 inch (0.51 mm).	Blend.

NOTE: LP turbine rotor and stator assemblies exhibiting damage in excess of above limits can be returned to a Pratt & Whitney Canada Approved Overhaul Facility for possible repair and refurbishment.

10. Fits, Clearances and Torque Loadings

TABLE 603, Fits and Clearances

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1168	Shaft, Low Compressor	1.9900 (50.546)	1.9905 (50.559)	0.003T (0.076T)	0.0045T (0.114T)	
	Disk, Turbine, Fourth-stage	1.986 (50.444)	1.987 (50.470)			
1169	Shaft, Low Compressor	1.7710 (44.983)	1.7715 (44.996)	0.002T (0.051T)	0.0035T (0.089T)	
	Disk, Turbine, Fourth-stage	1.768 (44.907)	1.769 (44.933)			
1170	Disk, Turbine, Fourth-stage	2.4814 (63.028)	2.4821 (63.045)	0.0002T (0.005T)	0.0021T (0.053T)	
	Seal, Air, No. 4 Bearing	2.4800 (62.992)	2.4812 (63.022)			
1171	Disk, Turbine, Fourth-stage	2.4208 (61.488)	2.4215 (61.506)	0.0004 (0.010)	0.0015T (0.038T)	
	Seal, Air, No. 4 Bearing	2.4200 (61.468)	2.4212 (61.498)			
1172	Seal, Air, No . 4 Bearing	2.864 (72.746)	2.865 (72.771)	0.011 (0.279)	0.015 (0.381)	
	Carrier,Seal, No. 4 Brg Assy of	2.876 (73.050)	2.879 (73.127)			
1173	Shaft, Low Compressor	1.7610 (44.729)	1.7615 (44.742)	0.0005 (0.013)	0.0015T (0.038T)	
	Spacer, Sleeve, Flanged	1.7600 (44.704)	1.7615 (44.742)			
1174	Shaft, Low Compressor	1.750 (44.450)	1.751 (44.475)	0.0005 (0.013)	0.0015T (0.038T)	
	Spacer, Sleeve, Flanged	1.7495 (44.437)	1.7505 (44.463)			

TABLE 603, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1175	Seal, Air, No. 4 Bearing	2.8153 (71.509)	2.8160 (71.526)	0.0025 (0.063)	0.0042 (0.107)	
	Seal, Carbon, No. 4 Bearing	2.8185 (71.590)	2.8195 (71.615)			
1176	Seal, Carbon, No. 4 Bearing	3.524 (89.510)	3.526 (89.560)	0.003T (0.076T)	0.007T (0.178T)	
	Carrier, Seal, No. 4 Bearing	3.519 (89.383)	3.521 (89.433)			
1177	Carrier, Seal, No. 4 Bearing	3.6816 (93.513)	3.6825 (93.536)	0.0002T (0.005T)	0.0025T (0.064T)	
	Case, Assy of, Turbine Exhaust	3.6800 (93.472)	3.6814 (93.508)			
1178	Plug, LP Shaft, Rear	1.238 (31.445)	1.242 (31.547)	0.005 (0.127)	0.012 (0.305)	
	Shaft, LP	1.247 (31.674)	1.250 (31.750)			
1179	Plug, LP Shaft Rear	1.278 (32.461)	1.282 (32.563)	0.005 (0.127)	0.012 (0.305)	
	Shaft, LP	1.287 (32.690)	1.290 (32.799)			
1182	Shaft, LP	1.7326 (44.008)	1.7333 (44.026)	0.0002T (0.005T)	0.0019T (0.048T)	
	Ring, Retaining, No. 4 Brg	1.7314 (43.978)	1.7324 (44.003)			
1187	Pre-SB24015 Rotor - Assy of, Turbine, Stage 5	21.670 (550.418)	21.690 (550.926)	0.001 (0.025) Radial	0.015 (0.381)	
	Ring - Assy of, Seal, Outer, Stage 5	21.692 (550.977)	21.700 (551.180)			

TABLE 603, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1187	Post-SB24015 Pre-SB24504 Rotor - Assy Of, Turbine, Stage 5	21.670 (550.418)	21.690 (550.926)	0.009 (0.229)	0.023 (0.584) Radial	
	Ring - Assy Of, Seal, Outer, Stage 5	21.708 (551.383)	21.716 (551.586)			
1187	Post-SB24504 Rotor - Assy Of, Turbine, Stage 5	21.666 (550.316)	21.694 (551.028)	0.024 (0.609)	0.042 (1.067) Radial	
	Ring - Assy Of, Seal, Outer, Stage 5	21.742 (552.247)	21.750 (552.450)			
1188	Pre-SB24015 Rotor - Assy of, Turbine, Stage 5	21.590 (548.386)	21.610 (548.894)	0.001 (0.025)	0.015 (0.381) Radial	
	Ring - Assy of, Seal, Outer, Stage 5	21.612 (548.945)	21.620 (549.148)			
1188	Post-SB24015 Pre-SB24504 Rotor - Assy Of, Turbine, Stage 5	21.590 (548.386)	21.610 (548.894)	0.009 (0.229)	0.023 (0.584) Radial	
	Ring - Assy Of, Seal, Outer, Stage 5	21.628 (549.351)	21.636 (549.554)			
1188	Post-SB24504 Rotor - Assy Of, Turbine, Stage 5	21.586 (548.284)	21.614 (548.996)	0.024 (0.609)	0.042 (1.067) Radial	
	Ring - Assy Of, Seal, Outer, Stage 5	21.662 (550.215)	21.670 (550.450)			
1213	Case, Assy of, Turbine	22.486 (571.144)	22.490 (571.246)	0.002T (0.051T)	0.010T (0.254T)	
	Case, Assy of, Turbine Exhaust	22.480 (570.992)	22.484 (571.094)			

TABLE 604, Torque and Stretch

REF. NO.	Name	Limits Min.	Limits Max.
1706	Retaining Nut		
	NOTE: Lubricate threads with engine oil. (1) Tighten nut 756 to 1260 lb.in. (85.4 to 142.4 Nm) Turn nut thru angle of 53 to 56 degrees and loosen 0 lb.in. (0 Nm). (2) Tighten nut 444 to 780 lb.in. (50.2 to 88.1 Nm). (3) Establish common reference points between nut and shaft. (4) Turn nut through further angle of 39 to 42 degrees. (5) Loosen nut to 0 lb.in. (0 Nm), and repeat step 2. (6) If nut reference points are in line with mating part reference point or beyond it within 3.9 degrees Max, apply final angle of turn per step 4. (7) If the reference points are not within limits, repeat steps 3, 4 and 5 in order until reference points are within limits, then perform step 6.		

TABLE 605, Spring Pressures

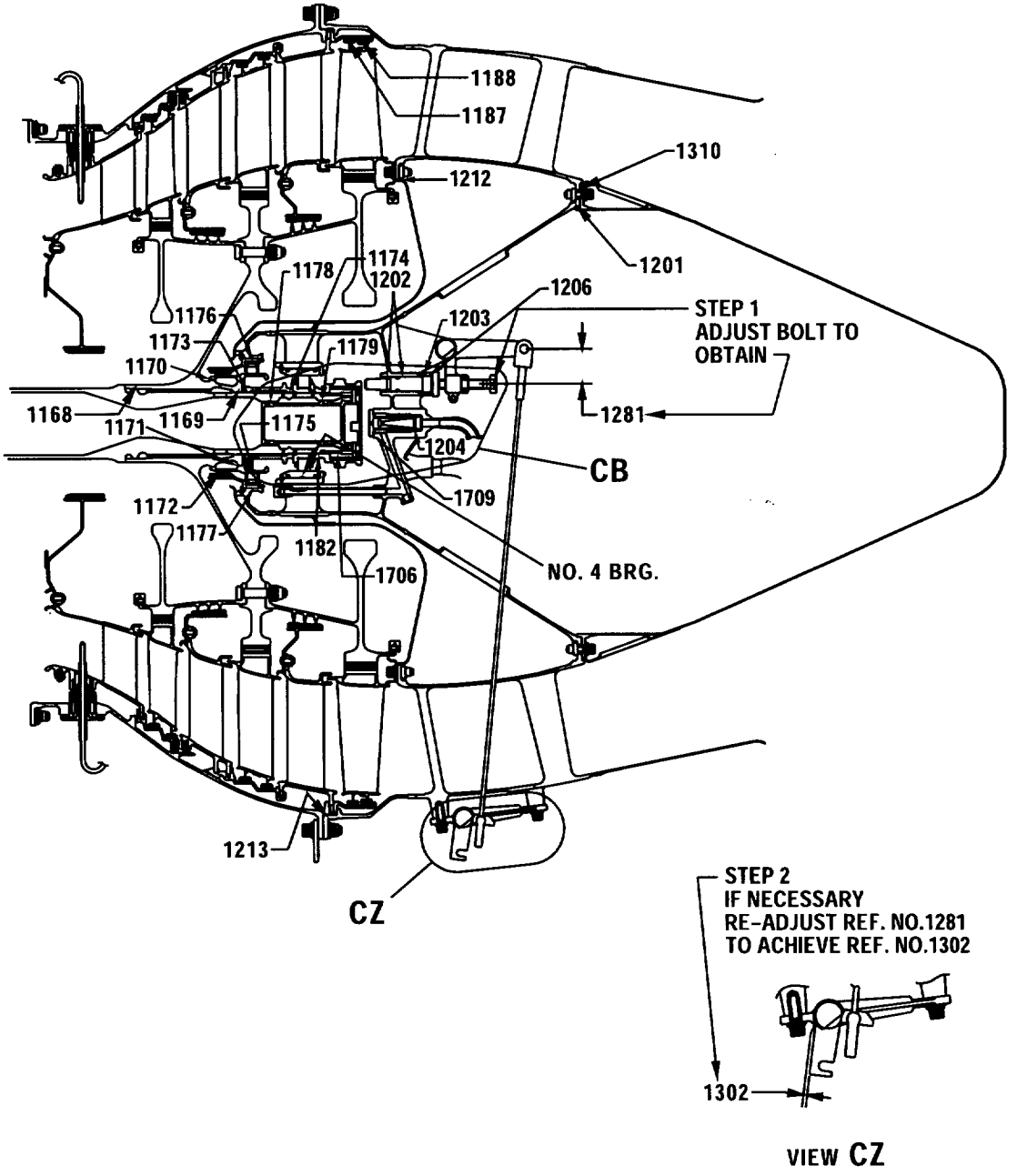
REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		

TABLE 606, Special Assembly Procedures

REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		

TABLE 607, Backlash

REF. NO.	Name	Limits Min.	Limits Max.
NOT APPLICABLE			



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LP Turbine Module - Fits and Clearances
Figure 602

EXHAUST CASE - REMOVAL/INSTALLATION

1. General

   A. The following section describes the removal and installation of the exhaust case assembly and the No. 4 bearing assembly. This procedure is intended for use during Heavy Maintenance.

   B. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   C. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers, and suppliers addresses.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-089	Lockwire
PWC06-009	Compound, Antiseize
PWC011-014B	Compound, isopropyl alcohol

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC40538	Heater, Exhaust case
PWC43026	Sling
PWC43580	Puller
PWC43581	Puller
PWC43582	Base
PWC43583	Puller
PWC43584	Drift
PWC63141	Drift
PWC63224	Base
PWC63410	Puller
PWC69269	Adapter, Heat gun
PWC89835	Air cooling tool

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Externals

CAUTION: DO NOT ROTATE ENGINE MORE THAN 10 DEGREES FROM HORIZONTAL POSITION.

A. Removal

(1) Disconnect N1 speed probe wiring harness from N1/T4.5 terminal box (Ref. 77-20-01).

(2) Move bellcrank of fuel shut-off cable to forward position and secure to exhaust case with lockwire (PWC05-089). This will prevent disengagement of cable from actuating lever inside exhaust case. Disconnect fuel shut-off cable (Ref. 73-10-05).

(3) Disconnect No. 4 bearing pressure and scavenge oil tubes from exhaust case (Ref. 79-20-03 and 79-20-04).

6. Exhaust Case

A. Removal of Exhaust Case (Ref. Figs. 401 and 402).

(1) Mark top centre position of exhaust case (1, Fig. 402) with an approved marker.

(2) If necessary, remove Post-SB24276 bolts (13) and fairing (14).

(3) Remove 12 bolts (12, Fig. 401), shield (11) and exhaust cone (10).

(4) Attach sling (PWC43026) to exhaust case at exhaust cone mating flange.

(5) Remove two angle brackets (7, Fig. 402) and fuel shut-off cable support bracket (6).

(6) Remove 32 nuts (2) and bolts (5), two cowl support brackets (4) and twelve cowl support brackets (8).

(7) Attach hoist to lifting eye on sling (PWC43026) and remove the slack in the hoist to support the weight of the exhaust case.

CAUTION: THE FIFTH-STAGE SEAL RING (3) IS HELD IN PLACE BY THE EXHAUST CASE. MAKE SURE RING DOES NOT FALL FROM ENGINE WHEN REMOVING THE EXHAUST CASE.

(8) Remove remaining 16 nuts (2) and bolt (5) from Flange F.

(9) If required, mark the top center position of the fifth-stage outer seal ring (3), prior to removal, using an approved marker.

NOTE: Seal ring may already have P/N oriented to the top center position.

CAUTION: REMOVE EXHAUST CASE EVENLY. MAKE SURE NO DAMAGE OCCURS TO CARBON SEAL OR SEAL CARRIER.

(10) Remove exhaust case from LP turbine module using four jacking screws (0.190-32 UNF thread) on Flange F.

(11) Remove fifth-stage outer seal ring (3).

B. Disassembly of Exhaust Case(Ref. Fig. 401 and 403)

NOTE: Perform usual inspection of the exhaust case without stripping the assembly. However should it be necessary to inspect the No. 4 bearing area, disassemble the exhaust case as required.

(1) Remove sixteen bolts (10) and heat shield (11) from turbine exhaust case (22, Fig. 403).

(2) Index mark seal carrier assembly (18) to exhaust case (22) with an approved marker.

(3) Remove retaining ring (17).

(4) Remove seal carrier (18) using puller (PWC43583).

CAUTION: USE CLEAN LINT FREE GLOVES WHEN HANDLING BEARINGS.

(5) Remove retaining ring (19) and No.4 bearing outer race (20). Remove and discard sealing rings (21).

(6) Remove bolt (5), nut (7) and loop clamp (6).

(7) Remove two bolts (4), two nuts (2) and bracket (3).

(8) Remove bolt (12), nut (14) and loop clamp (13).

(9) Remove two bolts (1), two nuts (9), bracket (8) and bracket (23) (Post-SB24037).

NOTE: The emergency fuel shut off valve upper mechanism can be inspected without disassembling. However if damage is noted, disassemble the mechanism.

(10) Remove lockwire at bell crank (9 Fig. 401).

(11) Remove end of cable (8) from slot in bell crank (9). Remove shouldered pin (1).

(12) Remove pin assembly (3). Retain spacer (5) with the pin.

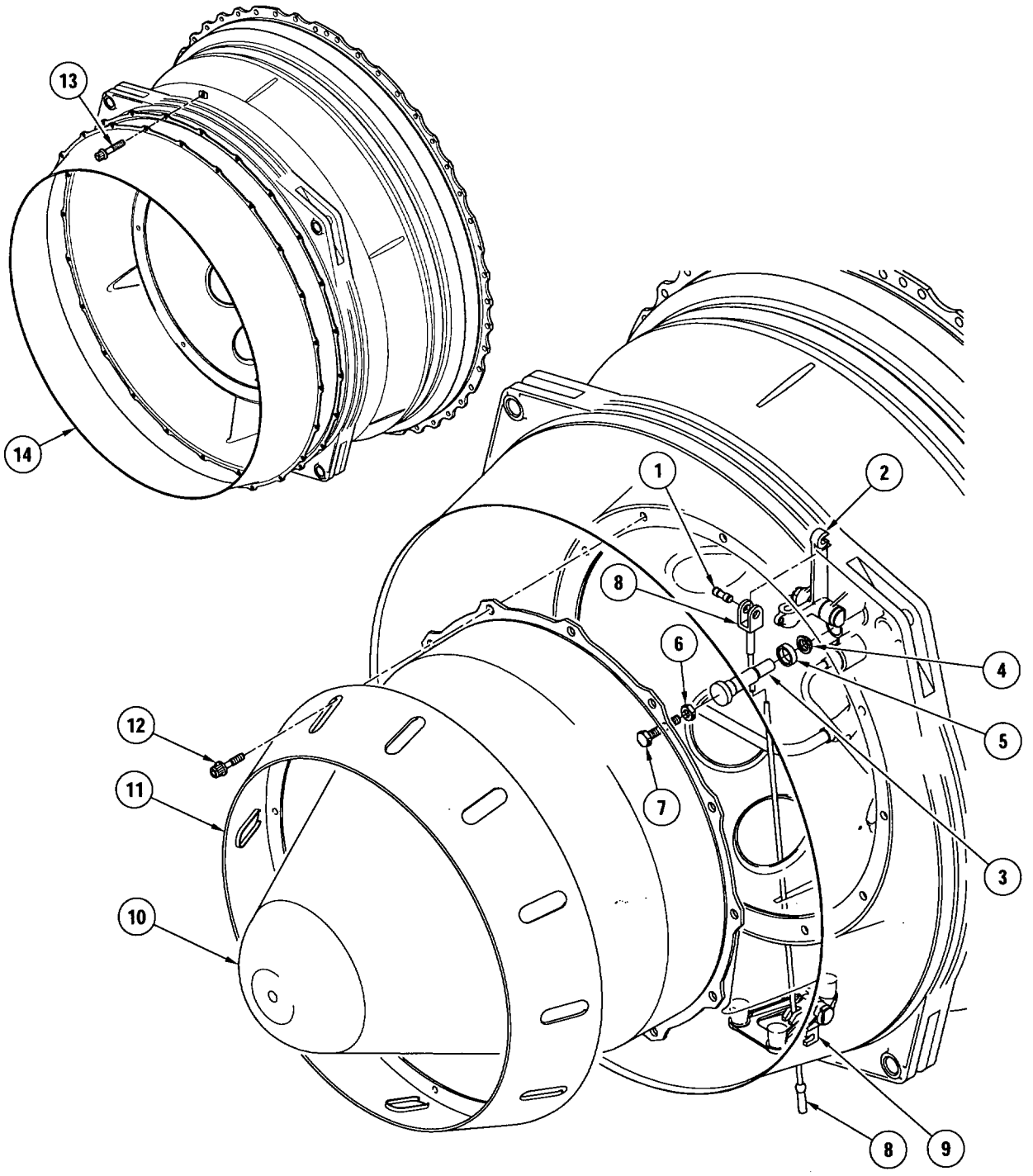
(13) Remove and discard seal (4).

(14) Remove lockwire, loosen nut (6, Fig. 401) and remove bolt (7).

C. Assembly of Exhaust Case (Ref. Fig. 404)

(1) Install brackets (2) and (23) (Post-SB24037) in turbine exhaust case (1) secure brackets with two self-locking nuts (3) and two bolts (4). Torque nuts 27 to 30 lb.in. (3.1-3.4 Nm).

(2) Secure No. 4 bearing oil pressure tube to bracket (2) using clamp (5), self-locking nut (6) and bolt (7). Torque nut 27 to 30 lb. in (3.1-3.4 Nm).



Exhaust Cone and Fuel Shut-off Mechanism - Removal/Installation
Figure 401

Key to Figure 401

1. Shoulder Pin
2. Lever
3. Grooved Pin
4. Plain Seal
5. Ring Spacer
6. Nut
7. Bolt
8. Control Cable Assembly
9. Bell Crank
10. Exhaust Cone Assembly
11. Cone Shield
12. Bolt
13. Bolt
14. Fairing

(3) Install bracket (8) in turbine exhaust case (1) and secure to case with two self-locking nuts (9) and two bolts (10). Torque nuts 27 to 30 lb.in. (3.1-3.4 Nm).

(4) Secure No. 4 bearing oil scavenge tube to bracket (8) with clamp (12), self-locking nut (11) and bolt (13). Torque nuts 27 to 30 lb.in. (3.1-3.4 Nm).

CAUTION: WEAR CLEAN LINT FREE GLOVES WHEN HANDLING BEARINGS.

(5) Install two seal rings (14) on No. 4 bearing outer race (15). Make sure seal ring joints are staggered 180 degrees apart.

CAUTION: WEAR CLEAN LINT FREE GLOVES WHEN HANDLING BEARINGS.

(6) Install No. 4 bearing outer race (15) into turbine exhaust case (1), with serial number facing upwards. Make sure anti-rotation lug on bearing engages with exhaust case.

(7) Install retaining ring (16).

D. Assembly of No. 4 Bearing Seal Carrier (Ref. Fig. 405)

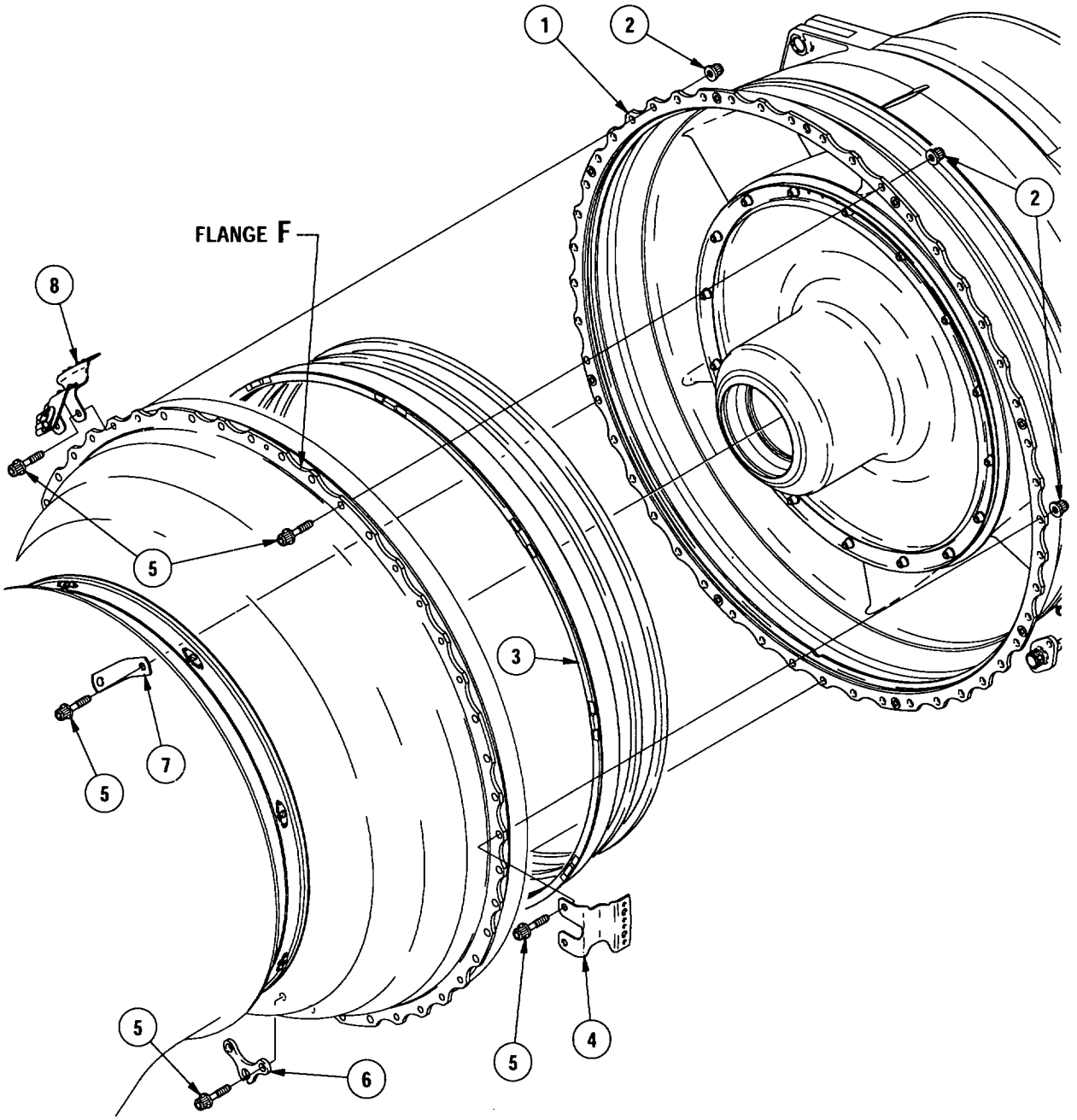
WARNING: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(1) Place seal carrier (2) in oven at 204°C (400°F) for 15 minutes minimum.

(2) Place the carbon seal in a plastic bag and put carbon seal in freezer at -40°C (-40°F).

WARNING: WEAR HEAT RESISTANT GLOVES WHEN HANDLING HOT PARTS.

(3) Pre-SB24563: Remove seal carrier (2) from oven and put on base (PWC43582). Remove No. 4 bearing carbon seal (3) from the freezer and install in seal carrier (2) with drift (PWC43581). Install retaining ring (5).



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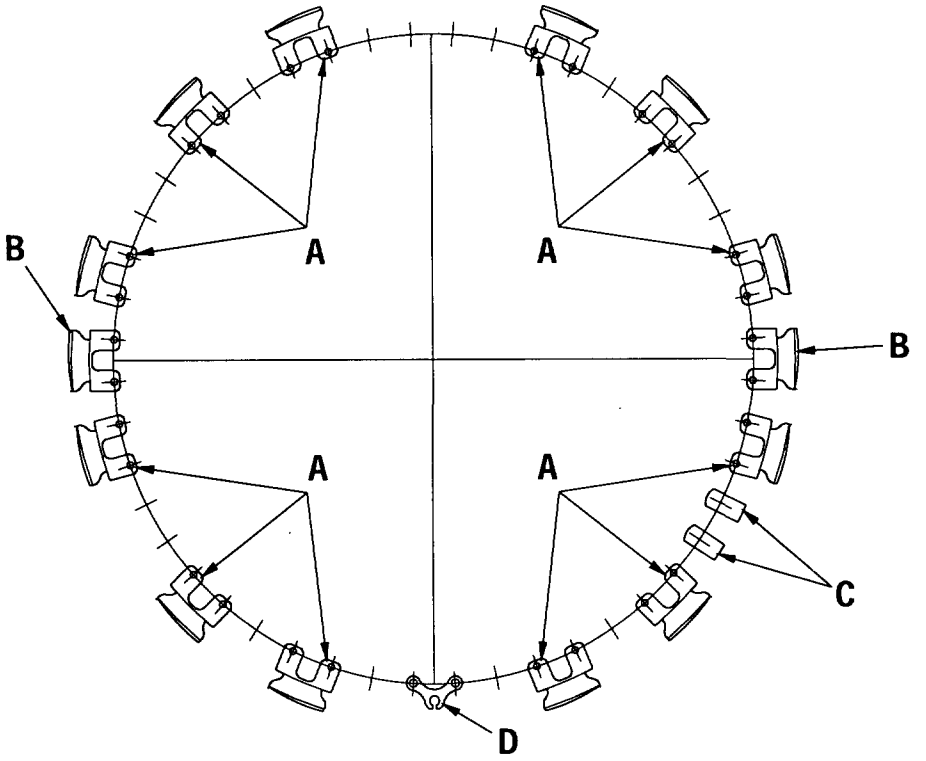
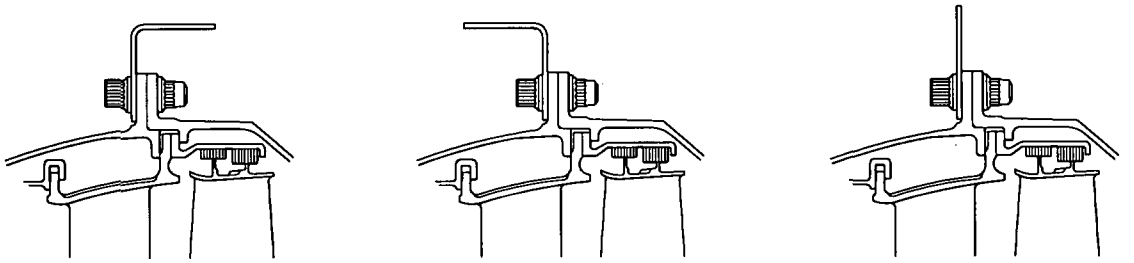
Exhaust Case - Removal/Installation
Figure 402 (Sheet 1 of 2)

Key to Figure 402

1. Exhaust Case Assembly
2. Self-locking Nut
3. Outer Seal Ring
4. Cowl Support Bracket
5. Bolt
6. Fuel Shut-off Cable Bracket
7. Angle Bracket
8. Cowl Support Bracket



VIEW LOOKING FORWARD
ON FLANGE F



LOCATION A AND B

LOCATION C

LOCATION D

FORWARD

C31356

Exhaust Case - Removal/Installation
Figure 402 (Sheet 2)

(4) Post-SB24563: Remove seal carrier (2) from oven and put on base (PWC63224). Remove No. 4 bearing carbon seal (3) from the freezer and install in seal carrier (2) with drift (PWC63141). Install retaining ring (5).

E. Installation of No. 4 Bearing Seal Carrier (Ref. Fig. 403)

(1) Clean exhaust case (22) and No. 4 bearing seal carrier mating surfaces with isopropyl alcohol (PWC011-014B).

(2) Put the heater (PWC40538) on exhaust case (22) and heat the exhaust case bore (22) for minimum of 12 to 15 minutes with a heat gun adapter (PWC69269).

(3) Remove heater (PWC40538) from the exhaust case (22) and Install seal carrier assembly (18) in to the exhaust case with drift (PWC43584). Install retaining ring (19).

(4) Cool the exhaust case assembly (22) with air cooling tool (PWC89835).

(5) Apply a thin layer of anti-seize compound (PWC06-009) to the thread of 16 bolts (10).

(6) Install heat shield (21). Secure with 16 bolts (22). Torque bolts 27 to 30 lb.in. (3.1-3.4 Nm).

F. Installation of Exhaust Case (Ref. Fig. 402)

CAUTION: MAKE SURE NEW OUTER SEAL RING (3) IS INSTALLED WITH P/N ALIGNED AT THE 12 O'CLOCK POSITION.

(1) For new outer seal ring installation, align and engage the lugs of the outer seal ring (3), making sure the seal ring is fully seated on the fifth-stage vane ring, with the seal ring P/N at the 12 o'clock position.

CAUTION: MAKE SURE USED OUTER SEAL RING (3) IS INSTALLED IN THE ORIGINAL POSITION, AS MARKED AT DISASSEMBLY.

(2) For used outer seal ring re-installation, align and engage the lugs of the outer seal ring (3), making sure the seal ring is fully seated on the fifth-stage vane ring, in the original location, as marked before disassembly.

(3) Attach sling (PWC43026) to exhaust case (1) at exhaust cone mating flange.

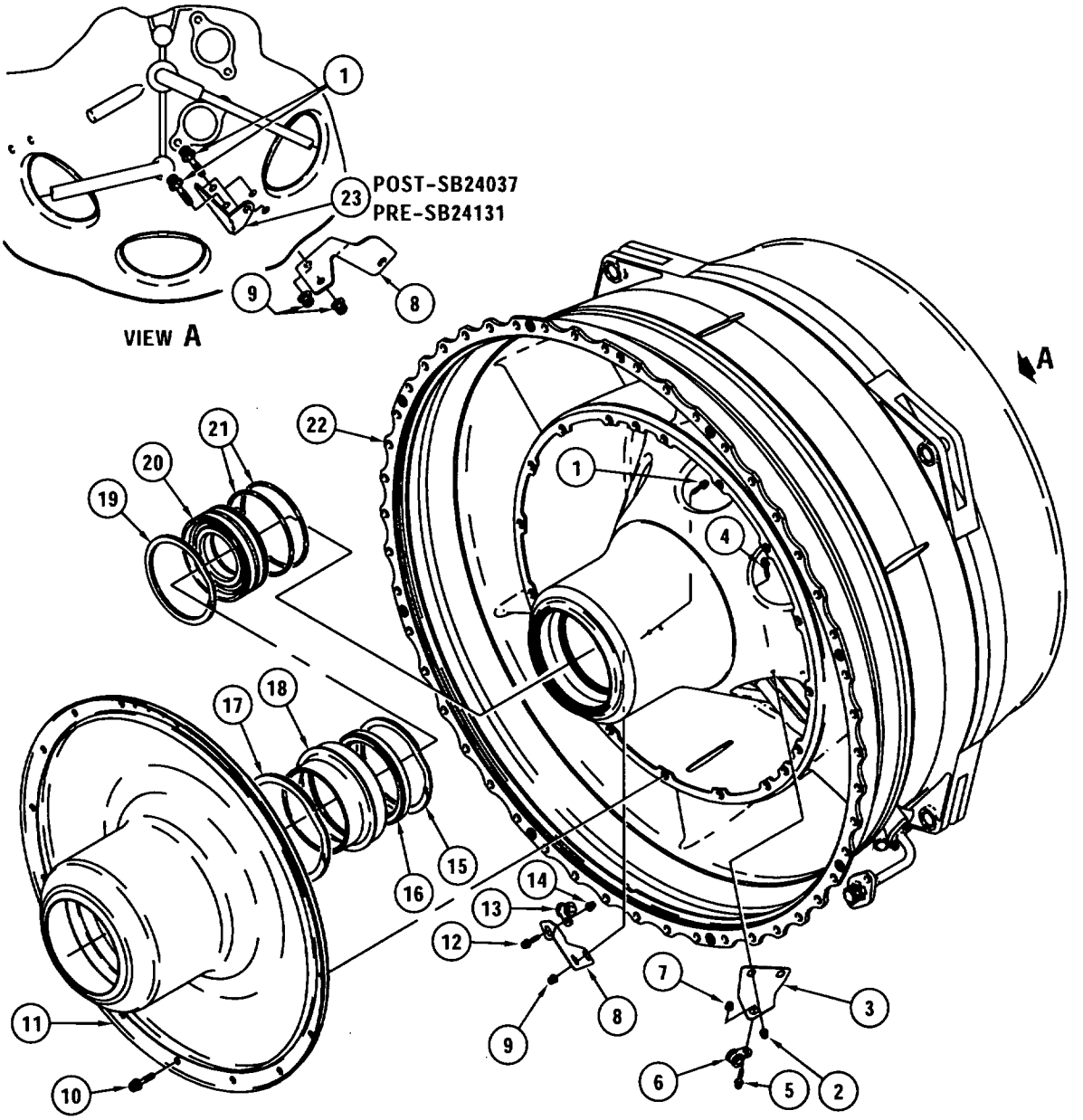
(4) Align top centre mark of exhaust case with mark on Flange F of LP turbine assembly. Engage locating pin and install exhaust case (1).

(5) Secure exhaust case and brackets to Flange F with 48 self-locking nuts (2) and bolts (5) as follows (Ref. Fig. 402 Sheet 2):

(a) Twelve brackets (8) at Location A.

(b) Two brackets (4) at Location B.

(c) Two brackets (7) at Location C.



C33315

Exhaust Case - Disassembly
Figure 403

Key to Figure 403

1. Bolt
2. Nut
3. Bracket
4. Bolt
5. Bolt
6. Loop Clamp
7. Nut
8. Bracket
9. Nut
10. Bolt
11. Heat Shield Assembly
12. Bolt
13. Loop Clamp
14. Nut
15. Retaining Ring
16. No. 4 Bearing Carbon Seal
17. Retaining Ring
18. No. 4 Bearing Seal Carrier Assembly (15, 16 Part of Assembly)
19. Retaining Ring
20. No. 4 Bearing Outer Race
21. Sealing Ring
22. Turbine Exhaust Case
23. Bracket (Post-SB24037)

(d) One bracket (6) at Location D.

(e) Torque all nuts 85 to 95 lb.in. (9.6-10.7 Nm).

(6) If removed, install Post-SB24276 fairing (14) with bolts (13). Tighten bolts 85 to 95 lb.in. (9.6-10.7 Nm).

7. No. 4 Bearing Carbon Seal

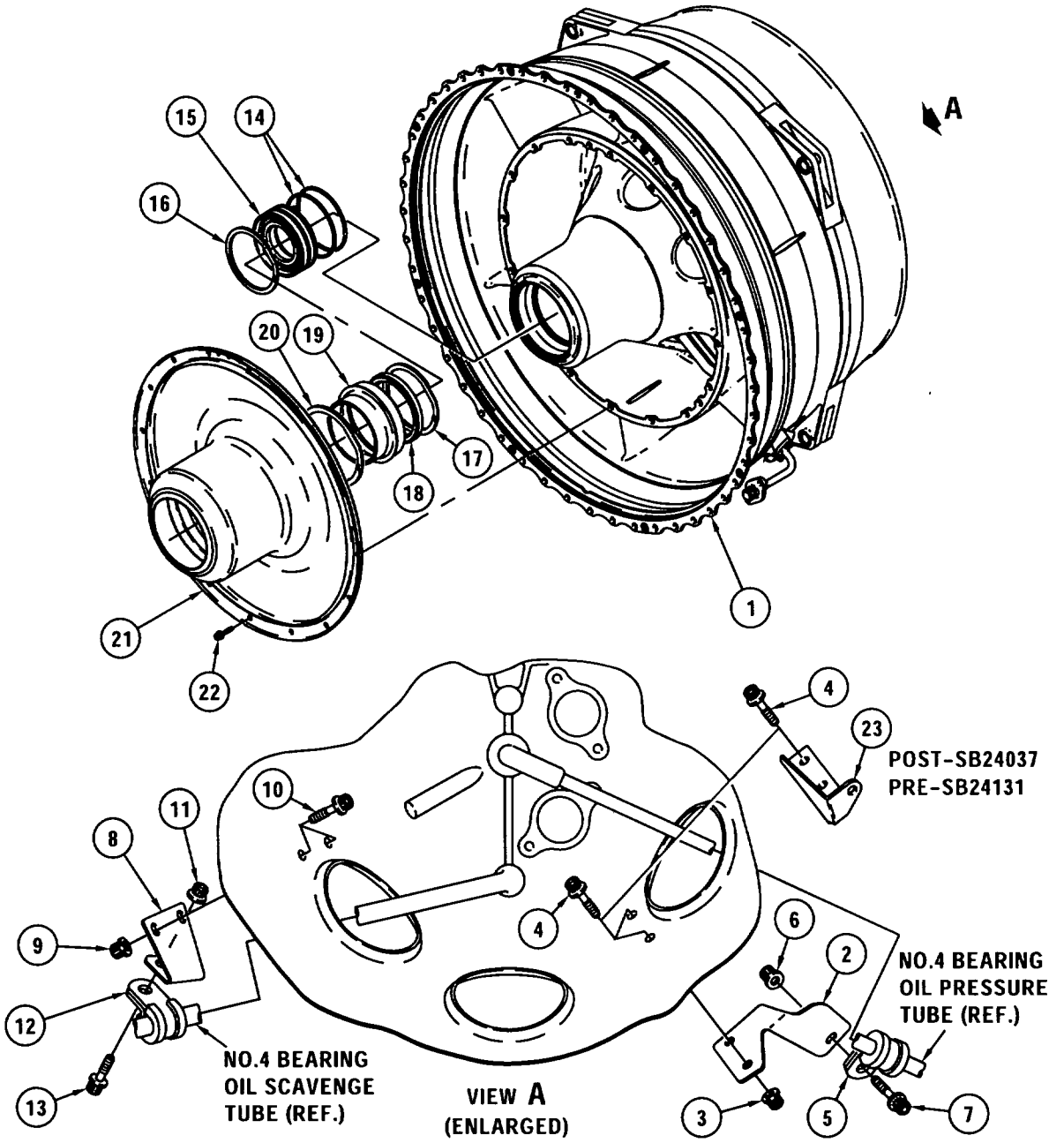
A. Removal (Ref. Fig. 405)

NOTE: The seal carrier assembly can be inspected without disassembling. However if damage is noted, disassemble seal carrier.

(1) Pre-SB24563:

(a) Mount seal carrier assembly on base (PWC43582).

(b) Remove retaining ring (5) from seal carrier (2).



C32791A

Exhaust Case - Assembly
Figure 404

Key to Figure 404

1. Turbine Exhaust Case
2. Bracket
3. Self-locking Nut
4. Bolt
5. Loop Clamp
6. Self-locking Nut
7. Bolt
8. Bracket
9. Self-locking Nut
10. Bolt
11. Self-locking Nut
12. Clamp
13. Bolt
14. Sealing Rings
15. No. 4 Bearing Outer Race
16. Retaining Ring
17. Retaining Ring
18. No. 4 Bearing Carbon Seal
19. No. 4 Bearing Seal Carrier Assembly
20. Retaining Ring
21. Heat Shield Assembly
22. Bolt
23. Bracket (Post-SB24037)

(c) Remove carbon seal (3) from seal carrier using puller (PWC43580).

(2) Post-SB24563:

(a) Mount seal carrier assembly on base (PWC63224).

(b) Remove retaining ring (5) from seal carrier (2).

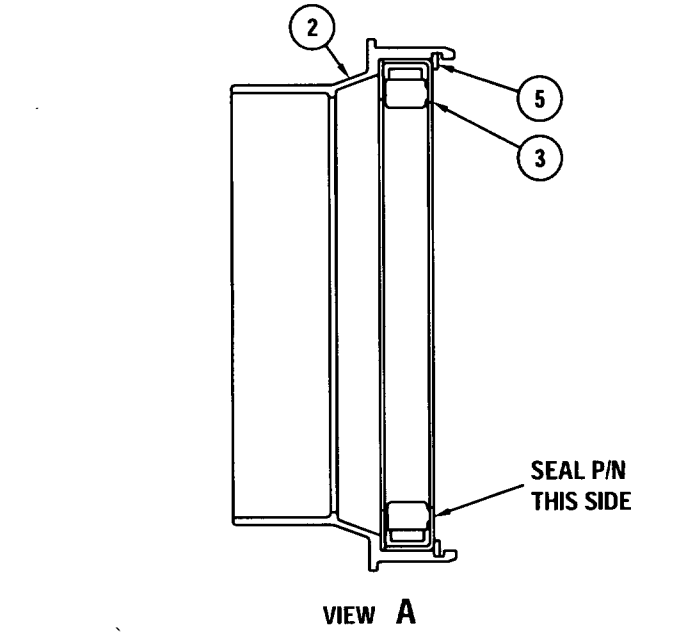
(c) Remove carbon seal (3) from seal carrier using puller (PWC63410).

8. Fuel Shut-off Mechanism and Exhaust Cone

A. Installation (Ref. Fig. 401)

(1) Make sure LP shaft is loaded in rearward direction.

(2) Calculate required spacer (5) thickness to achieve gap (Fits and Clearances REF. NO. 1282).



C33566

No. 4 Bearing Seal Carrier Assembly - Removal/Installation
Figure 405

Key to Figure 405

1. Exhaust Case
2. Seal Carrier
3. Carbon Seal
4. Retaining Ring
5. Retaining Ring

(3) Grind new or existing spacer (5) to thickness required ± 0.003 inch (0.076 mm).

NOTE: 1. Faces of spacer must be parallel within 0.002 inch (0.005 mm) and have a surface finish of 63 micro-inches or better.

NOTE: 2. Break sharp edges 0.004 to 0.020 inch (0.10-0.51 mm).

(4) Check for cracks. No cracks are permitted.

(5) Spray wash using petroleum solvent and air dry.

(6) Assemble pin (3), spacer (5) and seal (4) and install pin assembly into exhaust case.

(7) Adjust bolt (7) to obtain lever locating dimension (Fits and Clearances REF. NO. 1281) and secure with nut (6). Torque nut (6) 75 to 85 lb.in. (8.5-9.5 Nm) and lockwire (PWC05-089).

(8) Install cable assembly (8) on bell crank (9) and lever (2) with pin (1).

(9) Measure gap (Fits and Clearances REF. NO. 1302) at bell crank (9). If necessary, repeat step (7) to achieve required gap.

(10) Secure bell crank (9) to exhaust case with lockwire (PWC05-089) to prevent accidental dis-engagement of cable from lever (2).

(11) Apply anti-seize compound (PWC06-009) to 12 bolts (12) and secure exhaust cone (10) and cone shield (11) to exhaust case. Torque 27 to 30 lb.in. (3.0-3.4 Nm).

EXHAUST CASE ASSEMBLY- INSPECTION/CHECK

1. General

   A. This section provides instructions and limits for inspection/check of the exhaust case assembly.

   B. It is recommended that a magnifying glass of at least 10X power be used when visually inspecting for damage.

   C. Within the following text, where the term nicks or dents is used, unless otherwise specified, blend repair limits are applicable provided at least 70 percent of original surface remains undamaged.

   D. Parts found unsuitable for further engine running should be replaced. Rejected parts should be returned to Pratt & Whitney Canada for complete inspection and possible repair/refurbishment.

2. Consumable Materials

   Not Applicable

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Turbine Exhaust Case Assembly (Ref. Fig. 601)

   A. Visual Check of Case

      (1) Inspect for cracks. Cracks are acceptable within the following limits:

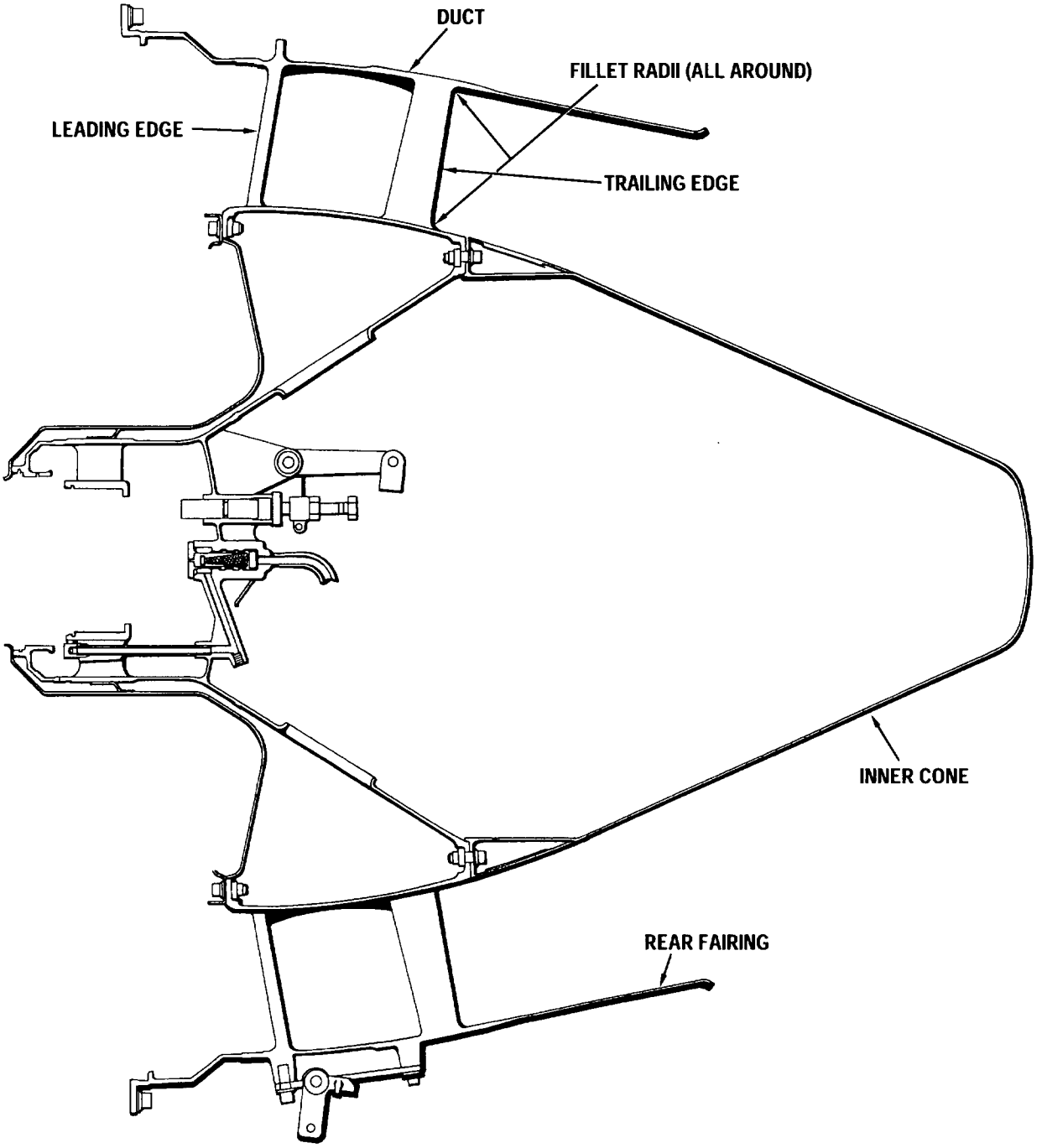
         (a) Strut leading and trailing edge, cracks acceptable to a maximum length of 0.250 inch (6.4 mm) provided cracks are non-converging.

         (b) Strut inner and outer fillet radii, cracks acceptable to a maximum length of 0.120 inch (3.0 mm) provided cracks are non-converging.

         (c) Welded seams; cracks acceptable to a maximum length of 0.120 inch (3.0 mm) provided cracks are separated by a minimum of 2.0 inches (50.8 mm) and are non-converging.

         (d) Cracks acceptable to a maximum length of 0.250 inch (6.4 mm) provided cracks are separated by a minimum of 6.0 inch (152.4 mm) and are non-converging.

      (2) Visually inspect No. 4 bearing oil pressure tube for corrosion at the bottom of the exhaust case and at the center of the exhaust case.



C18863

Turbine Exhaust Case Assembly
Figure 601

(3) Reject exhaust case if any corrosion is found.

B. Visual Check of Rear Fairing

(1) Inspect for cracks in welded seams as follows:

(a) Cracks acceptable to a maximum length of 0.120 inch (3.0 mm) provided cracks are separated by a minimum of 2.0 inches (50.8 mm) and are non-converging.

(b) Cracks acceptable to a maximum length of 0.250 inch (6.4 mm) provided cracks are separated by a minimum of 6.0 inch (152.4 mm) and are non-converging.

6. Inner Cone and Shield

A. Inner Cone (Ref. Fig. 602)

(1) Inspect for cracks in welded seams as follows:

(a) Cracks acceptable to a maximum length of 0.120 inch (3.0 mm) provided cracks are separated by a minimum of 2.0 inches (50.8 mm) and are non-converging.

(b) Cracks acceptable to a maximum length of 0.250 inch (6.4 mm) provided cracks are separated by a minimum of 6.0 inch (152.4 mm) and are non-converging.

B. Cone Shield (Ref. Fig. 602)

(1) Check weld seams. One crack acceptable to a maximum length of 0.060 inch.

(2) No cracks permitted on remainder of shield.

(3) Check for nicks, burrs and raised metal. Stone to remove raised metal or sharp edges.

(4) Check for dents or distortion. Reject if evident.

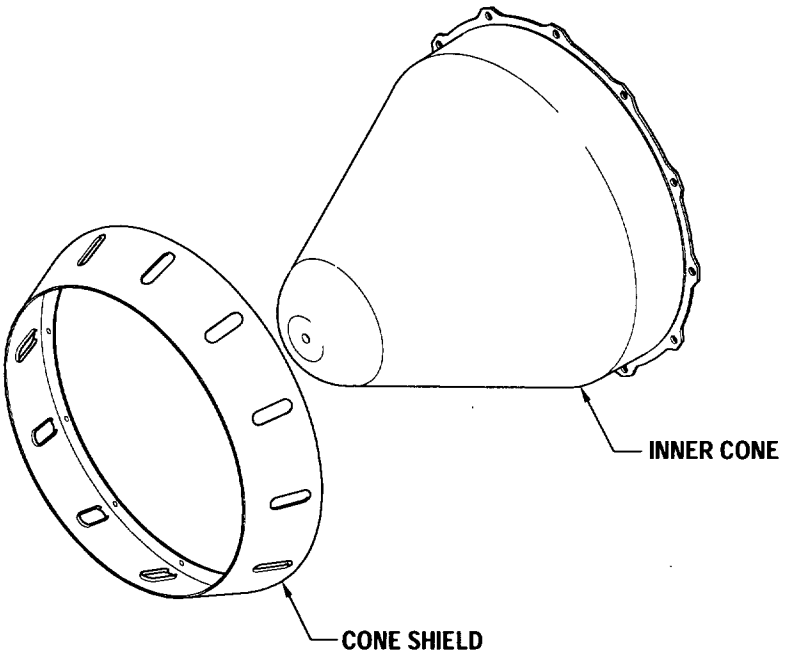
7. Fits, Clearances and Torque Loadings

A. General

The following pages provide the fits and clearances, torques, spring pressures, special assembly, and backlash checks.

All tables have metric equivalents given in parentheses either beside or below the imperial measurements.

For all tables, the indicated REF. NO. can be found on the Figure following the last table.



C70103

Exhaust Cone and Shield - Inspection
Figure 602

B. Dimensional Checks

The DIMENSIONS FOR REF. column indicates minimum and maximum manufacturing dimensions of two mating parts. These dimensions are provided for information only.

The LIMITS column indicates the desired minimum and maximum fits and clearances between new parts, and also the allowable limit to which these parts may wear before replacement is necessary.

The letter T indicates a tight fit; L or no letter, a loose fit.

BY SELECTION means parts must be matched by selection to provide a required fit.

FIT TO means a fitting operation may be required at assembly to obtain the required fit.

An asterisk (*) indicates part(s) should be replaced if any looseness is evident.

Unless otherwise stated, all fits are diametrical. Spline fits are calculated from chordal dimensions.

C. Torque Limits

Unless otherwise stated, apply thread lubricant to all parts that are to be torque-loaded.

Use engine lubricating oil or equivalent, unless otherwise specified.

Where torque limits for castle nuts are provided in the MINIMUM column only, these nuts should be tightened to the designated torque and then further tightened, if necessary, to properly align the locking slots and holes.

Where MINIMUM and MAXIMUM values are given, the alignment of the locking slot must be obtained without loosening the nut and without exceeding the maximum limit. If this is not possible, back-off the nut half a turn, then retighten. If alignment cannot be accomplished, select another nut.

Torque requirements for interference fit applications, such as studs, may be obtained with or without lubrication, unless otherwise specified.

TABLE 601, Fits and Clearances

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1281	Lever Locating Dimension			0.990 (25.15)	1.010 (25.65)	
1282	Pin, Grooved, Headed Ring-Retaining, No. 4 Brg.			0.100 (2.54) AXIAL	0.105 (2.67)	

TABLE 601, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1302	Bottom Lever Bracket			0.020 Min. (0.508)		

TABLE 602, Torque and Stretch

REF. NO.	Name	Limits Min.	Limits Max.
NOT APPLICABLE			

TABLE 603, Spring Pressures

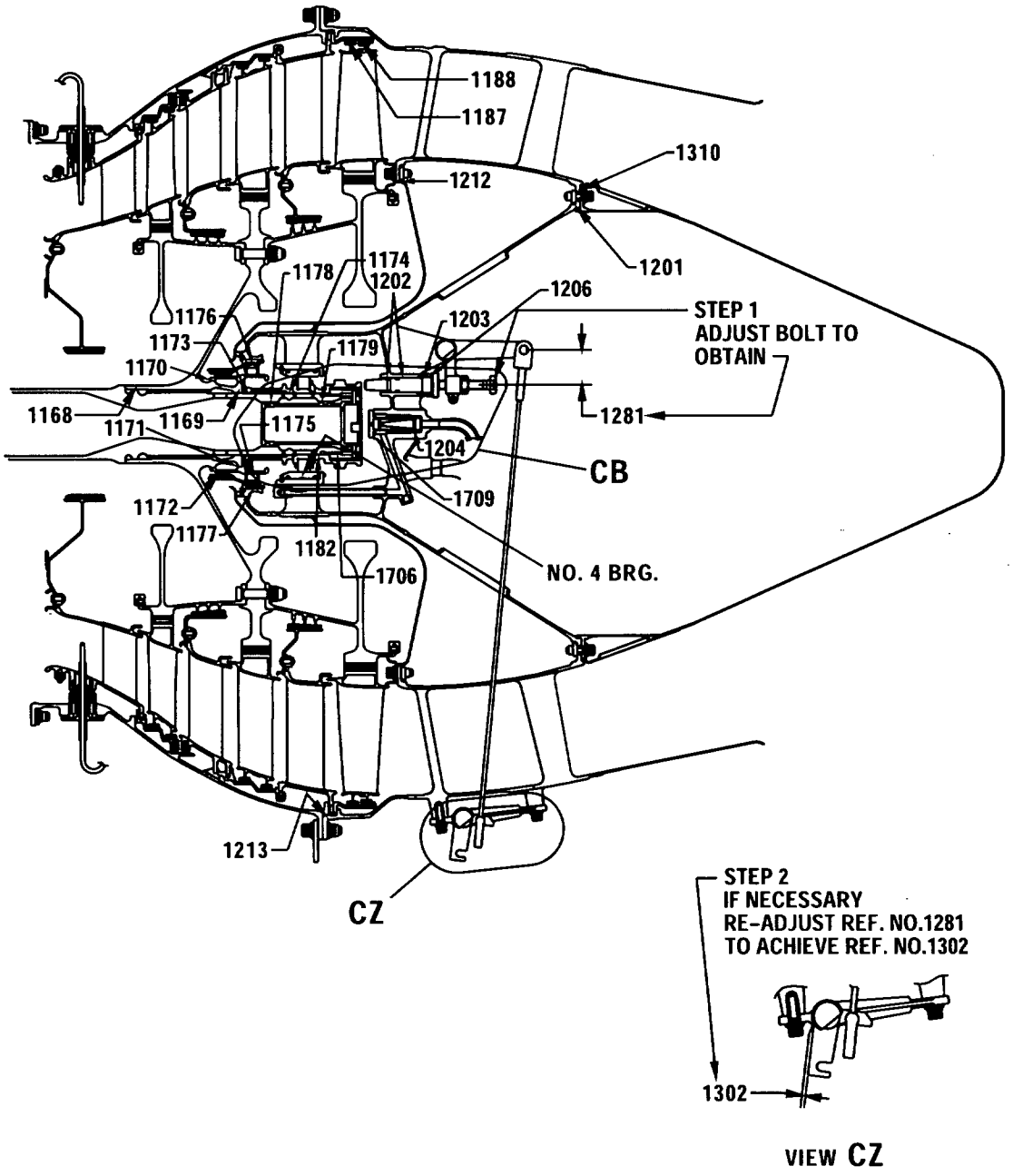
REF. NO.	Name	Limits Min.	Limits Max.
NOT APPLICABLE			

TABLE 604, Special Assembly Procedures

REF. NO.	Name	Limits Min.	Limits Max.
NOT APPLICABLE			

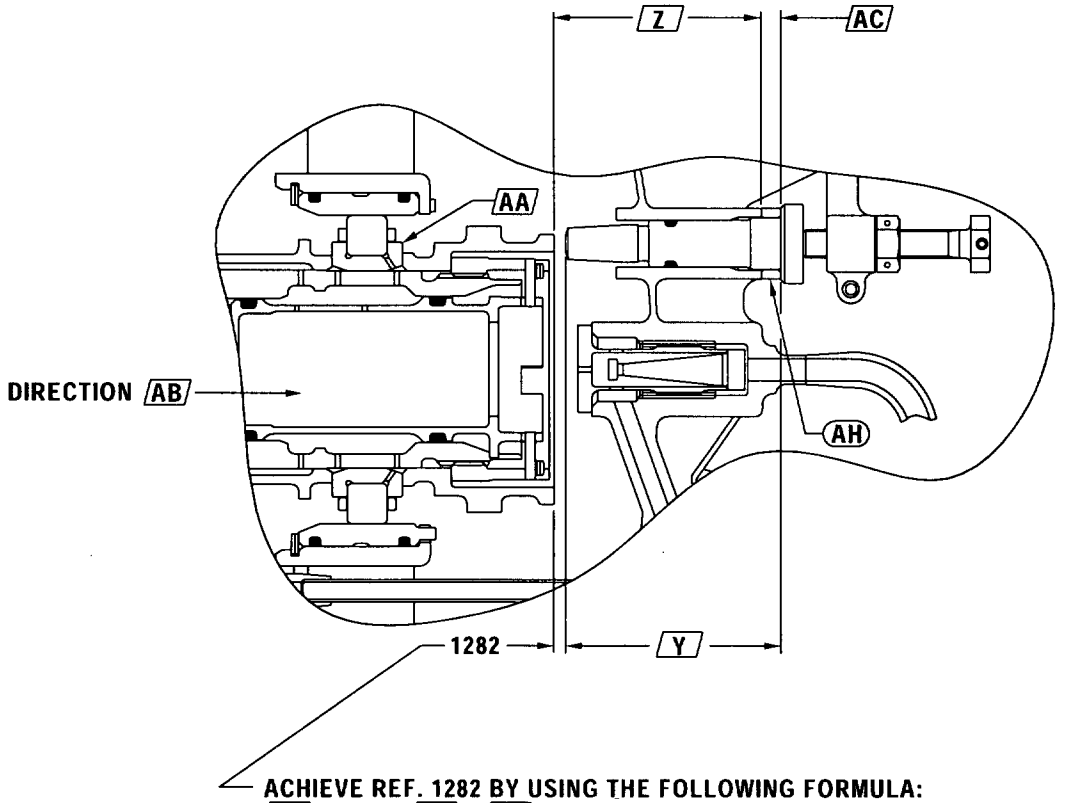
TABLE 605, Backlash

REF. NO.	Name	Limits Min.	Limits Max.
NOT APPLICABLE			



C33743

Exhaust Case - Fits and Clearances
Figure 603 (Sheet 1 of 2)



ACHIEVE REF. 1282 BY USING THE FOLLOWING FORMULA:
Y + 1282 - Z = AC (MULTIPLY BY 25.4 TO OBTAIN (SI) CORRESPONDING VALUES)
DIM. Z TO BE MEASURED WITH A LOAD OF 160 – 200 LBF (711.72–889.64 N) EXERTED ON THE INNER RING AA IN DIRECTION AB DIM. AC SELECT APPROPRIATE SPACER AH
GRIND SPACER TO ACHIEVE DIM. AC WITHIN ± .003 (0.076)

VIEW CB
SHOWING ADJUSTMENT FOR FUEL SHUT-OFF MECHANISM

C32738B

Exhaust Case - Fits and Clearances
Figure 603 (Sheet 2)

TABLE OF CONTENTS

SUBJECT	PAGE
ACCESSORY GEARBOX ASSEMBLY - DESCRIPTION AND OPERATION	**72-60-00**
1. Accessory Gearbox and Towershaft Section	1
2. Accessory Gearbox Assembly	1
ACCESSORY GEARBOX - MAINTENANCE PRACTICES	**72-60-01**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	202
5. Breather Adapter	202
A. Removal	202
B. Installation (Pre-SB24190)	207
C. Installation (Post-SB24190 or Pre-SB24303)	207
D. Installation of Breather Adapter Assembly (Post-SB24303 or Post-SB24330)	208
6. Square Drive Adapter (Pre-SB24190)	209
A. Removal	209
B. Installation	209
7. Hydraulic Pump Gearshaft	210
A. Removal of Hydraulic Pump Gearshaft Oil Seal	210
B. Installation of Hydraulic Pump Gearshaft Oil Seal (Pre-SB24303)	210
C. Installation of Hydraulic Pump Gearshaft Oil seal (Post-SB24303 or Post-SB24330)	210
D. Replacement of Splined Adapter	211
8. Permanent Magnet Alternator (PMA)	212
A. PMA Removal	212
B. Removal of PMA Oil Seal	212

TABLE OF CONTENTS

SUBJECT	PAGE
ACCESSORY GEARBOX - MAINTENANCE PRACTICES (Cont'd)	**72-60-01**
C. Installation of PMA Oil Seal (Pre-SB24303)	212
D. Installation of PMA oil seal (Post-SB24303 or Post-SB24330)	213
E. PMA Installation	215
9. Alternator or Starter Oil Seal	217
A. Removal of Alternator or Starter Oil Seal	217
B. Application of Sealant to Inside of Alternator or Starter Gearshaft	217
C. Installation of Alternator or Starter Oil Seal (Pre-SB24303)	218
D. Installation of Alternator or Starter Oil Seal (Post-SB24303 or Post-SB24330)	218
10. Cold Start Valve	220
A. Removal	220
B. Installation	221
11. Accessory Gearbox	223
A. Removal from Engine	223
B. Installation on Engine	227
12. Engine Identification and Trim Plates	229
A. Removal	229
B. Installation	229
13. Fits, Clearances and Torque Loadings	231

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Feb 15/2008
	2 blank	Feb 15/2008
Contents	1	Feb 15/2008
	2	Feb 15/2008
72-60-00	1	Nov 19/99
Description and	2	Nov 19/99
Operation	3	Nov 19/99
	4 blank	Nov 19/99
72-60-01	201	Feb 15/2008
Maintenance	202	Feb 15/2008
Practices	203	Feb 15/2008
	204	Feb 15/2008
	205	Feb 15/2008
	206	Feb 15/2008
	207	Feb 15/2008
	208	Feb 15/2008
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	235	Feb 15/2008
	236 blank	Feb 15/2008

ACCESSORY GEARBOX ASSEMBLY - DESCRIPTION AND OPERATION

1. Accessory Gearbox and Towershaft Section

The accessory gearbox is mounted below the engine on the intermediate casing, and is driven through an angled towershaft passing through the 6 o'clock strut of the intermediate casing. The splines of the towershaft engage bevel gears at both ends, the upper gear meshing with the bevel gear on the high pressure compressor rotor shaft, and the lower gear meshing with the bevel gear on the starter-generator driveshaft in the accessory gearbox. Two N2 speed sensor units, located in the accessory gearbox casing (RH side), pick up N2 speed signal pulses from a spur gear on the alternator driveshaft.

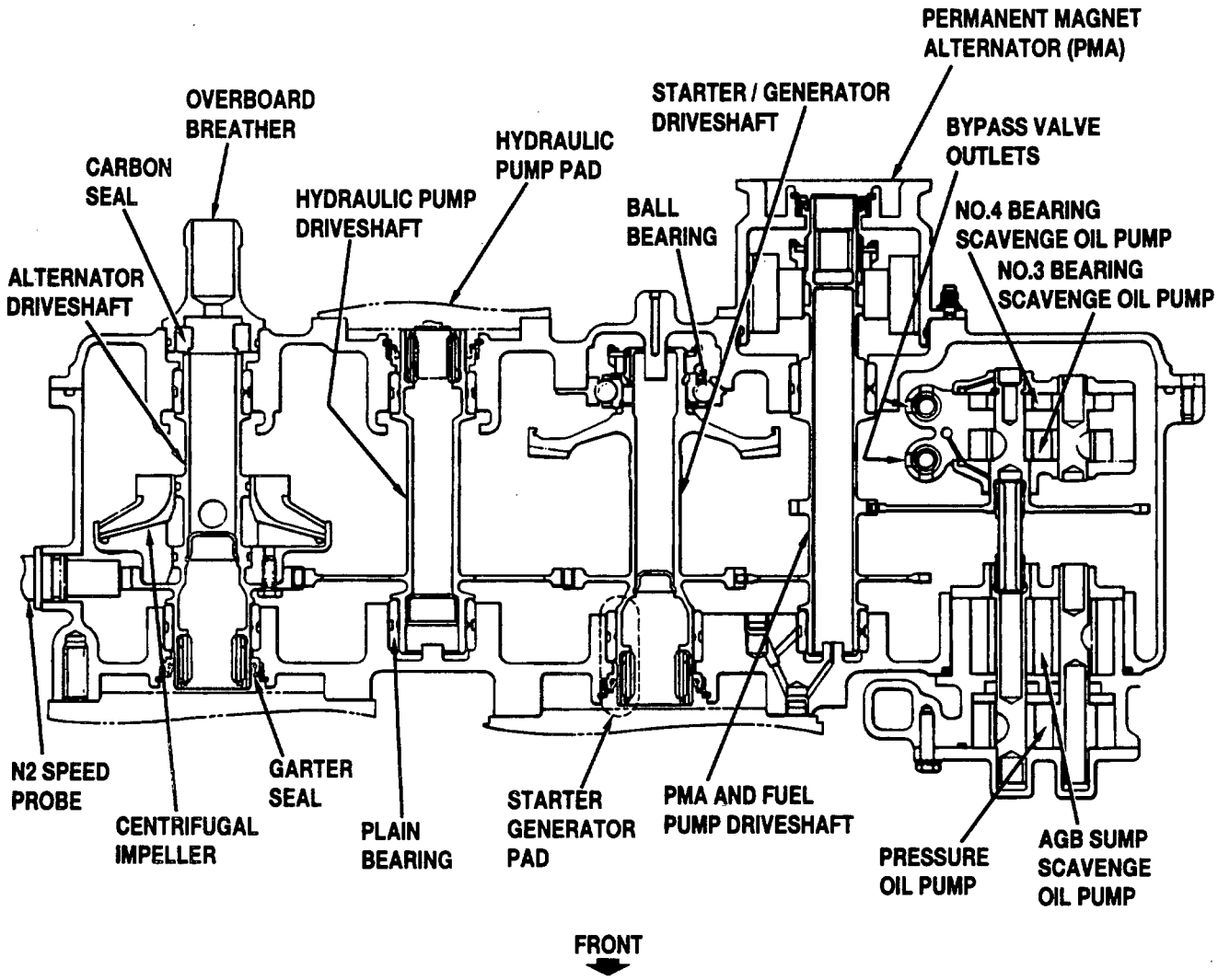
2. Accessory Gearbox Assembly (Ref. Figs. 1 and 2)

The accessory gearbox consists of a cast magnesium housing with a rear cover. An airframe-supplied starter-generator mounts on the starter-generator pad of the housing, and connects with the gearbox main shaft assembly. The main shaft assembly is supported by a plain bearing at the front of the housing and a ball thrust bearing in the gearbox cover at the rear. The main shaft has an integral spur gear which drives two gears supported by identical plain bearings in the housing and cover. Garter seals and retaining rings are mounted on the ends of all shafts. Oil trays installed in the housing reduce foaming. The alternating current (AC) generator mounts on a pad on the left of the gearbox cover and the hydro-mechanical metering unit (HMU), which houses the cartridge-type fuel pump, mounts to the AC generator. The right-hand pad on the cover provides for mounting of an airframe-supplied hydraulic pump.

The AC generator gearshaft drives a spur gear which, in turn, drives the pressure and scavenge oil pump assemblies mounted on the outer and inner left-hand side of the housing, respectively. The alternator shaft, which is driven by the hydraulic pump shaft, incorporates a centrifugal impeller for oil-air separation. An integral spur gear on the alternator shaft is the pulse generator gear supplying high-pressure rotor speed signals to two speed sensors. The speed sensors are radially located in the right-hand side of the accessory gearbox casing.

A chip detector is installed at the bottom of the gearbox casing. The chip detector provides an indication of ferrous particles in the lubrication system when a continuity check is performed. Provisions exist for airframe wiring to provide in-flight indication of contamination.

Pressure oil for the lubrication of the accessory gearbox bearing is routed via a transfer tube from the intermediate case and passes through integral passageways in the housing and cover. An engine data plate is riveted onto the engine identification plate installed at the underside of the accessory gearbox housing.



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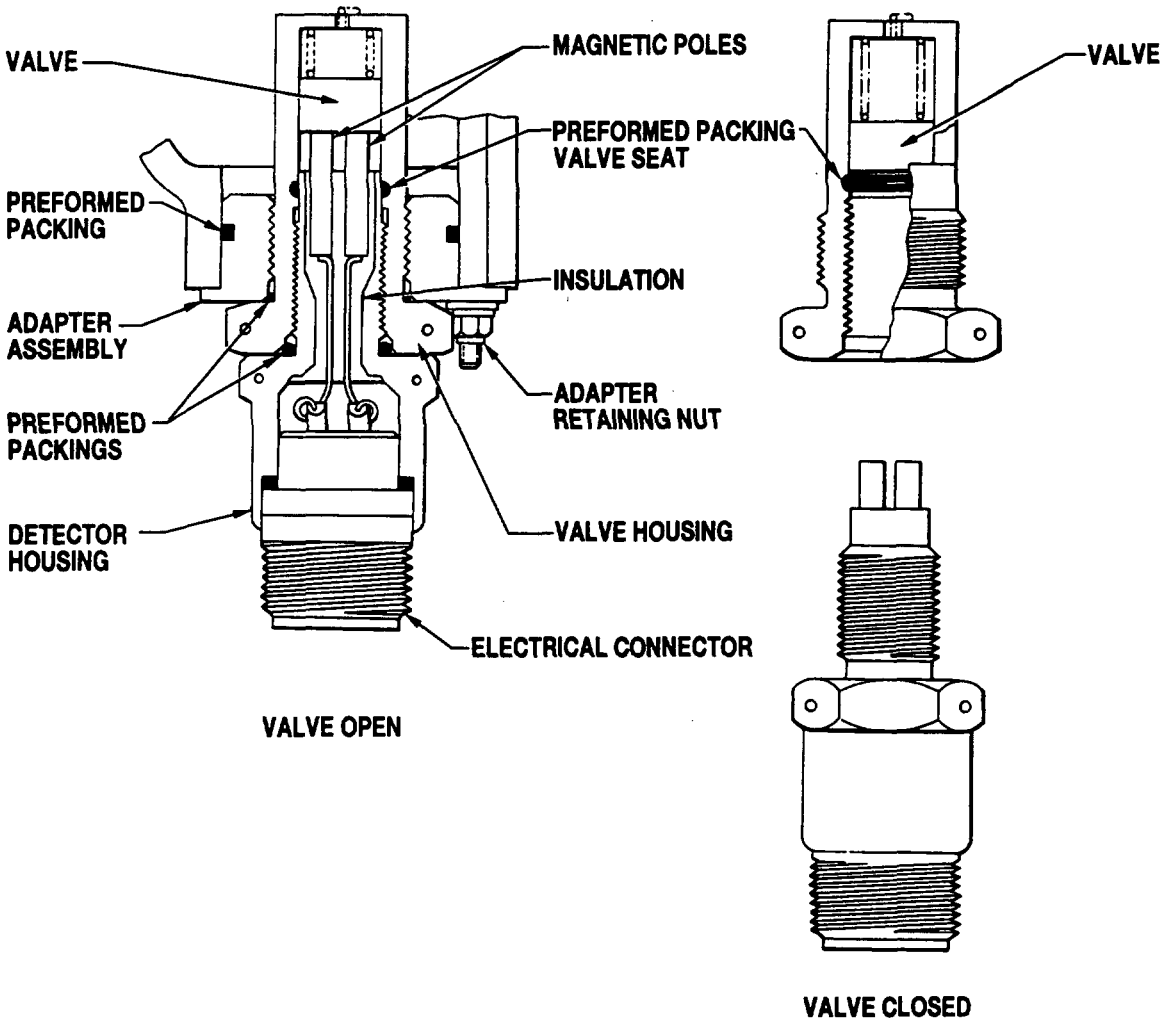
Accessory Gearbox Cross Section
Figure 1



C10186A

Self-closing Chip Detector - Schematic (Typical)
Figure 2

ACCESSORY GEARBOX - MAINTENANCE PRACTICES

1. General

A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

The consumable materials listed below are used in the following procedures.

Refer to CONSUMABLE MATERIALS section for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC03-001	Engine Oil
PWC05-014	Cloth, Abrasive
PWC05-089	Lockwire
PWC06-011	Fluid, Assembly
PWC06-013	Fluid, Assembly
PWC09-017	Adhesive/Sealant, Silicone Rubber
PWC09-017A	Adhesive/Sealant, Silicone Rubber
PWC11-014B	Isopropyl Alcohol
PWC11-027	Solvent

3. Special Tools

The special tools listed below are used in the following procedures.

Tool No.	Name	Application
PWC31062	Drift	Pre-SB24190
PWC31382-02	Extractor	Post-SB24190 or Post-SB24303 or Post-SB24330
PWC37088-002	Drift	Post-SB24190 or Pre-SB24303
PWC43125	Puller	
PWC43160	DELETED	Replaced by PWC60144
PWC43161	DELETED	Replaced by PWC43553
PWC43176	Puller	Pre-SB24190
PWC43177	Puller	
PWC43184	Extractor	Pre-SB24303
PWC43553	Socket	
PWC60142-100	Wrench	

Tool No.	Name	Application
PWC60144	Adapter	
PWC60224	Pilot	Pre-SB24303
PWC60225-01	Drift	Post-SB24303 or Post-SB24330
PWC60225-02	Drift	
PWC60225-03	Drift	
PWC60295	Extractor	Pre-SB24303
PWC60679	Extractor	Post-SB24303
PWC60682	Pusher	Post-SB24303 or Post-SB24330
PWC60683	Pusher	Post-SB24303 or Post-SB24330
PWC60684	Extractor	Post-SB24303
PWC60685	Pusher	Post-SB24303 or Post-SB24330
PWC61155	Drift	

4. Fixtures, Equipment and Supplier Tools

Not Applicable

5. Breather Adapter

A. Removal (Ref. Fig. 201)

(1) Remove two bolts (11) and two washers (10).

CAUTION: DO NOT DAMAGE SEAL INSTALLED IN BREATHER ADAPTER.

(2) Remove breather adapter (9) using puller (PWC43177).

(3) Remove and discard preformed packing (8).

NOTE: Breather seal can be inspected without removing it from the adapter.

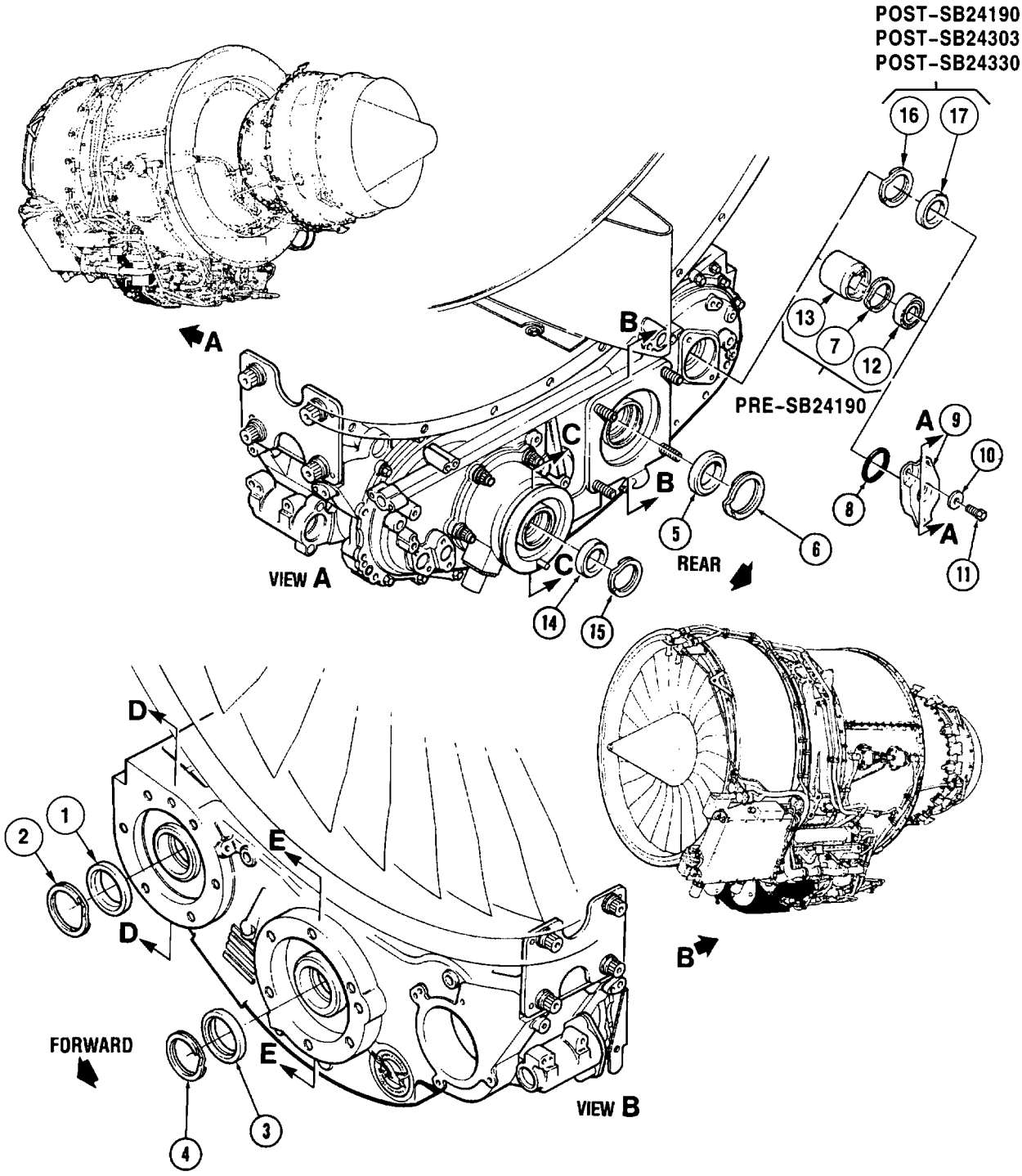
(4) Pre-SB24190:

(a) Remove carbon face seal (7) from breather adapter (9) using puller (PWC43176).

(5) Post-SB24190 or Post-SB24303 or Post-SB24330:

(a) Remove retaining ring (16).

(b) Remove seal (17) or (18) using extractor (PWC31382-02).

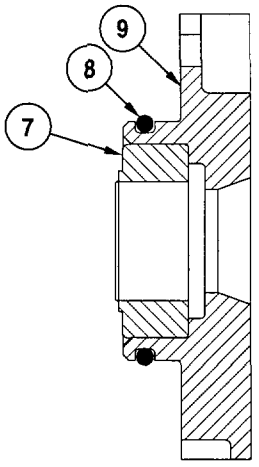


C21407C

Accessory Gearbox Seals and Adapter Replacement
Figure 201 (Sheet 1 of 3)

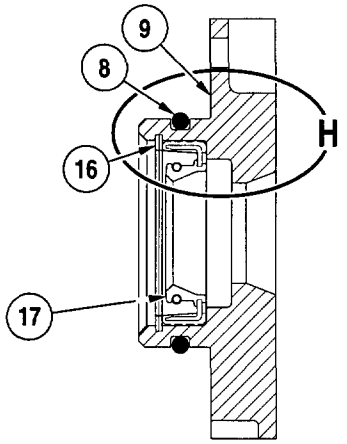
Key to Figure 201

1. Seal
2. Retaining Ring
3. Seal
4. Retaining Ring
5. Seal
6. Retaining Ring
7. Carbon Face Seal (Pre-SB24190)
8. Preformed Packing
9. Adapter Assembly
10. Washer
11. Bolt
12. Retaining Ring (Pre-SB24190)
13. Square Drive Adapter (Pre-SB24190)
14. Seal
15. Retaining Ring
16. Retaining Ring (Post-SB24190 or Post-SB24303 or Post-SB24330)
17. Plain Seal (Post-SB24190 or Post-SB24303 or Post-SB24330)
18. Deleted



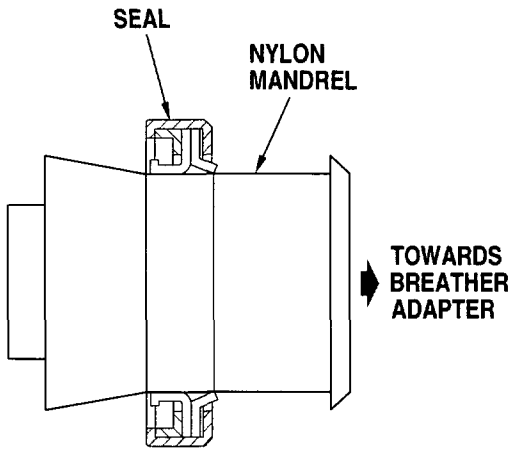
PRE-SB24190
BREATHER ADAPTER SEAL

SECTION A-A

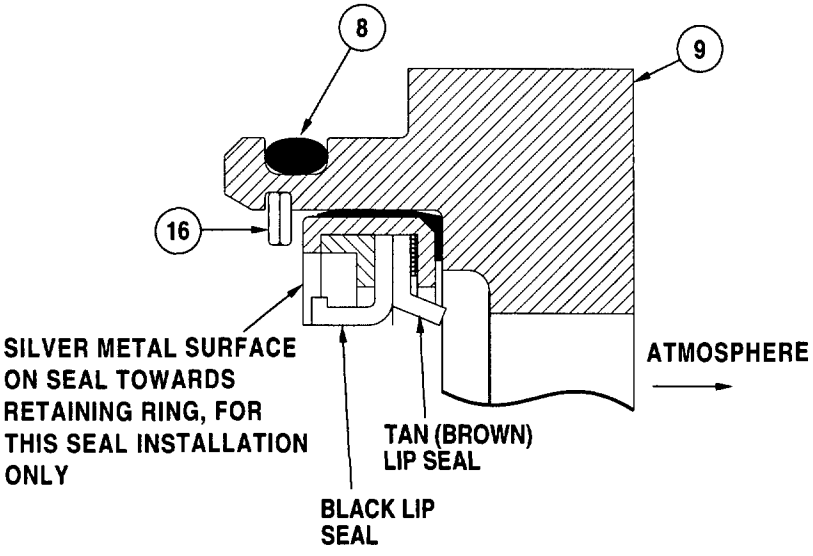


POST-SB24190
POST-SB24303
POST-SB24330
BREATHER ADAPTER SEAL

SECTION A-A



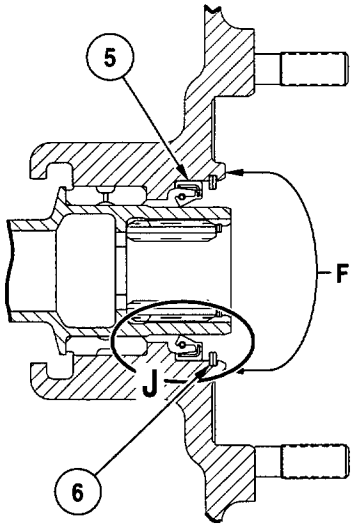
POST-SB24303
POST-SB24330
BREATHER ADAPTER SEAL



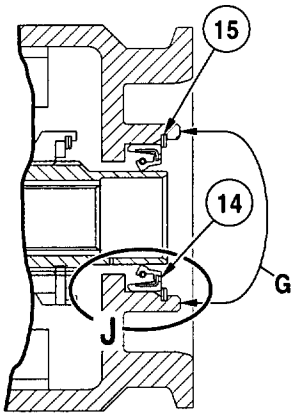
DETAIL H

C32635C

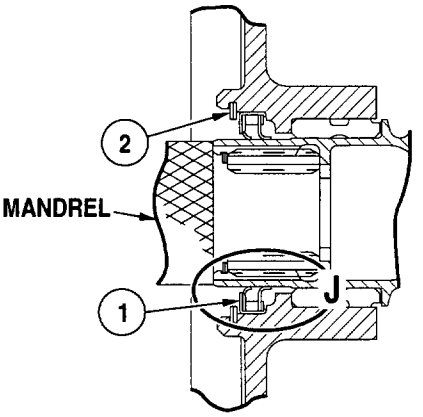
Accessory Gearbox Seals and Adapter Replacement
Figure 201 (Sheet 2)



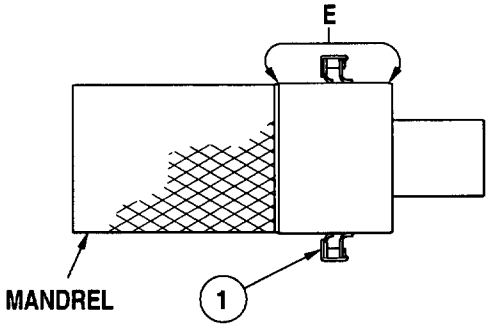
HYDRAULIC PUMP SEAL
SECTION B-B



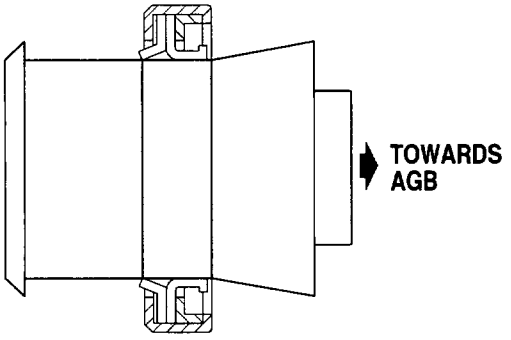
PMA AND FUEL PUMP SEAL
SECTION C-C



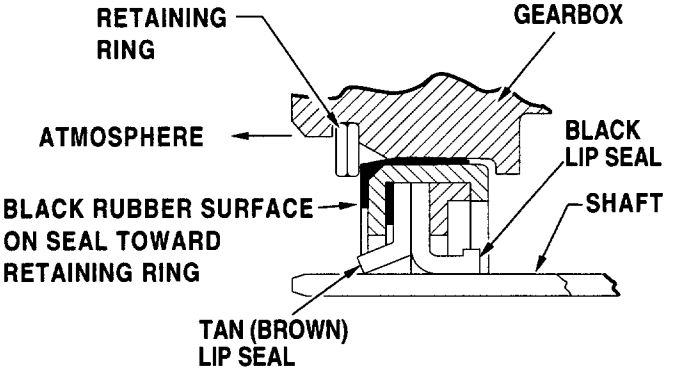
ALTERNATOR SEAL
SECTION D-D
STARTER SEAL
SECTION E-E (SIMILAR)



LOCATION OF AREA E



POST-SB24303
POST-SB24330
TYPICAL INSTALLATION
HYDRAULIC PUMP, PMA, ALTERNATOR/STARTER



DETAIL J

C35151B

Accessory Gearbox Seals and Adapter Replacement
Figure 201 (Sheet 3)

B. Installation (Pre-SB24190) (Ref. Fig. 201)

(1) Remove all engine oil from AGB gearshaft and dry with isopropyl alcohol (PWC11-014B).

NOTE: Clean and dry gearshaft will result in better seating of the oil seal that occurs during initial engine run.

WARNING: WEAR PROTECTIVE GLOVES WHEN HANDLING HOT PARTS.

(2) Place breather adapter (9) in oven heated to 300°F (149°C) for 20 minutes minimum.

WARNING: WEAR PROTECTIVE GLOVES WHEN HANDLING COLD PARTS.

(3) Place carbon seal (7) in clean plastic bag and place in freezer at -40°F (-40°C) for 15 minutes minimum.

(4) Remove breather adapter (9) from oven and place on bench.

(5) Lubricate and install preformed packing (8) on breather adapter assembly (9).

CAUTION: INSTALL CARBON SEAL CAREFULLY. IF CARBON SEAL DOES NOT SEAT PROPERLY OR JAMS DURING INSTALLATION, REMOVE AND REPEAT INSTALLATION PROCEDURE.

(6) Remove carbon seal (7) from the freezer and install in breather adapter with drift (PWC31062).

(7) Install breather adapter assembly (9) in the AGB cover and attach with two washers (10) and two bolts (11). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm).

CAUTION: MAKE SURE THAT THERE IS NO DAMAGE OF CARBON SEAL DURING INSTALLATION.

(8) If any damage is found, remove the carbon seal (7) and repeat the steps (1) to (6).

C. Installation (Post-SB24190 or Pre-SB24303) (Ref. Fig. 201)

(1) Remove all engine oil from AGB gearshaft and dry with isopropyl alcohol (PWC11-014B).

NOTE: Clean and dry gearshaft will result in better seating of the oil seal that occurs during initial engine run.

(2) Lubricate the breather adapter (9) bore with engine oil (PWC03-001).

(3) Heat the breather adapter (9) in hot oil tank for 10 minutes.

(4) Install seal (17) with drift (PWC37088-002).

NOTE: The seal is seated when it is below the retaining ring groove.

(5) Install retaining ring (16).

(6) Attach the breather adapter (9) to the AGB cover with two washers (10) and two bolts (11). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

D. Installation of Breather Adapter Assembly (Post-SB24303 or Post-SB24330) (Ref. Fig. 201)

(1) Heat the breather adapter housing (9) in an oven at 300 to 350°F (149-176°C) for 15 to 20 minutes.

NOTE: Make sure that the retaining ring groove is free and clear of any damage and that there is no raised material before heating the breather adapter housing.

WARNING: READ SUPPLIER'S MATERIAL SAFETY DATA SHEET BEFORE USING ASSEMBLY FLUID NO (PWC06-013).

WARNING: WEAR PROTECTIVE GLOVES WHEN HANDLING HOT PARTS.

(2) Remove breather adapter housing (9) from oven.

(3) Install the teflon installation ring into the retaining groove.

WARNING: READ SUPPLIER'S MATERIAL SAFETY DATA SHEET BEFORE USING ASSEMBLY FLUID NO (PWC06-013).

(4) Apply a thin layer of assembly fluid mixture (PWC06-013) to the outer surface of the seal.

CAUTION: DO NOT REMOVE MANDREL FROM THE SEAL (17).

CAUTION: INSTALL SEAL WITH SILVER METAL SURFACE AND BLACK LIP SEAL FACING THE RETAINING RING (THIS SEAL ONLY).

(5) Make sure that the seal orientation on the mandrel is correct.

(6) Align the mandrel to the end of the gearshaft.

CAUTION: MAKE SURE THE SEAL IS PUSHED STRAIGHT, NOT ON AN ANGLE.

(7) Push seal (17) off the mandrel onto the shaft.

(8) Use an arbor press to seat the seal (17) in the breather adapter with drift (PWC60225-01).

NOTE: Leave the mandrel in place.

CAUTION: MAKE SURE THAT THE SEAL IS SEATED BELOW THE RETAINING RING GROOVE.

CAUTION: MAKE SURE THAT THERE IS NO TEARING OF THE WIPER OR THAT THE RUBBER HAS NOT BEEN SUFFICIENTLY DEFORMED TO OBSTRUCT THE RETAINING RING GROOVE.

CAUTION: DO NOT REMOVE MANDREL FROM THE SEAL (17).

(9) Remove teflon installation ring from the retaining ring groove.

(10) Remove any excess material that may have been shaved off the seal casing during installation.

(11) Install retaining ring (16).

(12) Lubricate packing (8) with engine oil (PWC03-001) and install on breather adapter (9).

(13) Clean the gearshaft in the area of the seal lip contact use solvent (PWC11-014B).

NOTE: A clean and dry gearshaft will result in better seating of the oil seal that occurs during initial engine run.

(14) Align mandrel to the end of the gearshaft. Seat the breather adapter (9) by hand.

(15) Remove and discard the mandrel.

(16) Attach the breather adapter to the AGB cover with two washers (10) and two bolts (11). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

6. Square Drive Adapter (Pre-SB24190)

NOTE: The Post-SB24190 square drive adapter is integral with the alternator drive gearshaft and cannot be removed.

A. Removal (Ref. Fig. 201)

(1) Remove breather adapter (9) (Ref. Para. 5.).

(2) Remove retaining ring (12).

(3) Remove square drive adapter (13).

B. Installation

(1) Install square drive adapter (13) in alternator drive gearshaft.

(2) Install retaining ring (12).

(3) Install breather adapter (9) (Ref. Para.5.).

7. Hydraulic Pump Gearshaft

A. Removal of Hydraulic Pump Gearshaft Oil Seal (Ref. Fig. 201)

(1) Remove the hydraulic pump to gain access to the hydraulic pump oil seal (Ref. Aircraft Maintenance Manual).

(2) Remove retaining ring (6) (Ref. Section B-B).

(3) Pre-SB24303: Remove seal (5) with extractor (PWC43184).

(4) Post-SB24303 or Post-SB24330: Remove seal (5) with extractor (PWC60684).

B. Installation of Hydraulic Pump Gearshaft Oil Seal (Pre-SB24303) (Ref. Fig. 201)

(1) Clean any raised material from retaining ring groove.

(2) Remove all engine oil from AGB gearshaft and dry with isopropyl alcohol (PWC11-014B).

NOTE: A clean and dry gearshaft will result in better seating of the oil seal that occurs during initial engine run.

(3) Heat housing at area F (Ref. Section B-B) for 20 minutes using suitable a heat gun.

CAUTION: MAKE SURE THAT THE SEAL IS SEATED BELOW THE RETAINING RING GROOVE.

CAUTION: MAKE SURE THAT THERE IS NO TEARING OF THE WIPER OR THAT THE WIPER HAS NOT COME OUT OF THE SEAL.

(4) Install seal (5) as indicated using drift (PWC60225-02).

(5) Remove excess material that may have been shaved off the seal outside diameter of seal during installation.

(6) Install retaining ring (6).

(7) Install hydraulic pump (Ref. Aircraft Maintenance Manual).

C. Installation of Hydraulic Pump Gearshaft Oil seal (Post-SB24303 or Post-SB24330) (Ref. Fig. 201)

(1) Clean the gearshaft, where the seal lip will touch, with isopropyl alcohol (PWC11-014B) before installing the seal.

NOTE: A clean and dry gearshaft will result in better seating of the oil seal that occurs during initial engine run.

(2) Install the teflon installation ring (supplied with seal) in the retaining ring groove in the housing.

NOTE: Make sure that the retaining ring groove is free and clear of any damage and that there is no raised material before installing the teflon ring.

WARNING: READ SUPPLIER'S MATERIAL SAFETY DATA SHEET BEFORE USING ASSEMBLY FLUID NO (PWC06-013).

(3) Apply a thin layer of assembly fluid mixture (PWC06-013) to the outer surface of the seal.

CAUTION: DO NOT REMOVE THE MANDREL FROM THE SEAL.

(4) Make sure the seal orientation on the mandrel (supplied with the seal) is correct.

NOTE: The beige colored seal lip must face out towards retaining ring groove.

(5) Align the mandrel to the end of the gearshaft.

CAUTION: MAKE SURE THE SEAL IS PUSHED STRAIGHT, NOT ON AN ANGLE.

(6) Push seal (5) off the mandrel on the shaft.

(7) Remove the mandrel while holding seal in place. Discard the mandrel.

(8) Seat the seal with seal pusher (PWC60683). Torque seal pusher 50 to 60 lb.in. (5.6- 6.7 Nm).

CAUTION: MAKE SURE THAT THE SEAL IS SEATED BELOW THE RETAINING RING GROOVE.

CAUTION: MAKE SURE THAT THERE IS NO TEARING OF THE WIPER OR THAT THE RUBBER HAS NOT BEEN SUFFICIENTLY DEFORMED TO OBSTRUCT THE RETAINING RING GROOVE.

(9) Remove teflon installation ring from the retaining ring groove.

(10) Remove any excess material that may have been shaved off the seal casing during installation.

(11) Install retaining ring (6).

(12) Install hydraulic pump (Ref. Aircraft Maintenance Manual).

D. Replacement of Splined Adapter

(1) Remove retaining ring from inside of gearshaft.

(2) Remove splined adapter using puller (PWC60635).

(3) Clean the internal splines with isopropyl alcohol (PWC11-014B) and lubricate with engine oil (PWC03-001).

(4) Install new splined adapter using drift (PWC61155).

(5) Install retaining ring inside gearshaft.

8. Permanent Magnet Alternator (PMA)

A. PMA Removal (Ref. Fig. 202)

CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN DISCONNECTING ELECTRICAL CONNECTORS.

(1) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).

(2) Remove the HMU (Ref. Chapter 73-20-01, HYDROMECHANICAL METERING UNIT - MAINTENANCE PRACTICES).

(3) Disconnect wiring harness connectors P11 and P12 from AC generator housing connectors (12 and 13).

(4) Remove five self-locking nuts (10) and washers (9) securing AC generator housing (8) to AGB cover.

(5) Remove housing (8). Discard preformed packing (7).

(6) Remove retaining ring (6) and keywasher (5).

(7) Remove retaining nut (4) with socket (PWC43553) and adapter (PWC60144).

(8) Remove rotor (3).

B. Removal of PMA Oil Seal (Ref. Fig. 201 and 202)

(1) If necessary, remove the HMU (Ref. Chapter 73-20-01, HYDROMECHANICAL METERING UNIT - MAINTENANCE PRACTICES).

(2) Remove retaining ring (15, Fig. 201 and 202).

CAUTION: DO NOT DAMAGE THE DRIVE SHAFT OUTSIDE DIAMETER.

(3) Remove the PMA (Ref. Subpara. A.).

(4) Push seal (14) out from inside of the PMA housing (8, Fig. 202), with teflon drift.

C. Installation of PMA Oil Seal (Pre-SB24303) (Ref. Fig. 201)

(1) Clean any raised material from retaining ring groove.

(2) Remove all engine oil from AGB gearshaft and dry using alcohol (PWC11-014B).

NOTE: A clean and dry gearshaft will result in better seating of the oil seal that occurs during initial engine run.

(3) Heat seal housing (Ref. Area G, Section C-C) for 10 minutes with a suitable heat gun.

CAUTION: MAKE SURE THAT THE SEAL IS SEATED BELOW THE RETAINING RING GROOVE.

CAUTION: MAKE SURE THAT THERE IS NO TEARING OF THE WIPER OR THAT THE WIPER HAS NOT COME OUT OF THE SEAL.

(4) Install seal (14) as indicated with drift (PWC60225-01).

(5) Remove any excess material that may have been shaved off the seal casing during installation.

(6) Install retaining ring (15).

(7) If necessary, install the HMU (Ref. Chapter 73-20-01, HYDROMECHANICAL METERING UNIT - MAINTENANCE PRACTICES).

D. Installation of PMA oil seal (Post-SB24303 or Post-SB24330) (Ref. Fig. 201)

(1) Clean the gearshaft, where the seal lip will touch with isopropyl alcohol (PWC11-014B) before installing the seal.

NOTE: A clean and dry gearshaft will result in better seating of the oil seal that occurs during initial engine run.

(2) Install the teflon installation ring (supplied with seal) in the retaining ring groove in the housing.

NOTE: Make sure that the retaining ring groove is free and clear of any damage and that there is no raised material before installing the teflon ring.

WARNING: READ SUPPLIER'S MATERIAL SAFETY DATA SHEET BEFORE USING ASSEMBLY FLUID NO (PWC06-013).

(3) Apply a thin layer of assembly fluid mixture (PWC06-013) to the outer surface of the seal.

CAUTION: DO NOT REMOVE THE MANDREL FROM THE SEAL.

(4) Make sure the seal orientation on the mandrel (supplied with the seal) is correct.

NOTE: The beige colored seal lip must face out towards retaining ring groove.

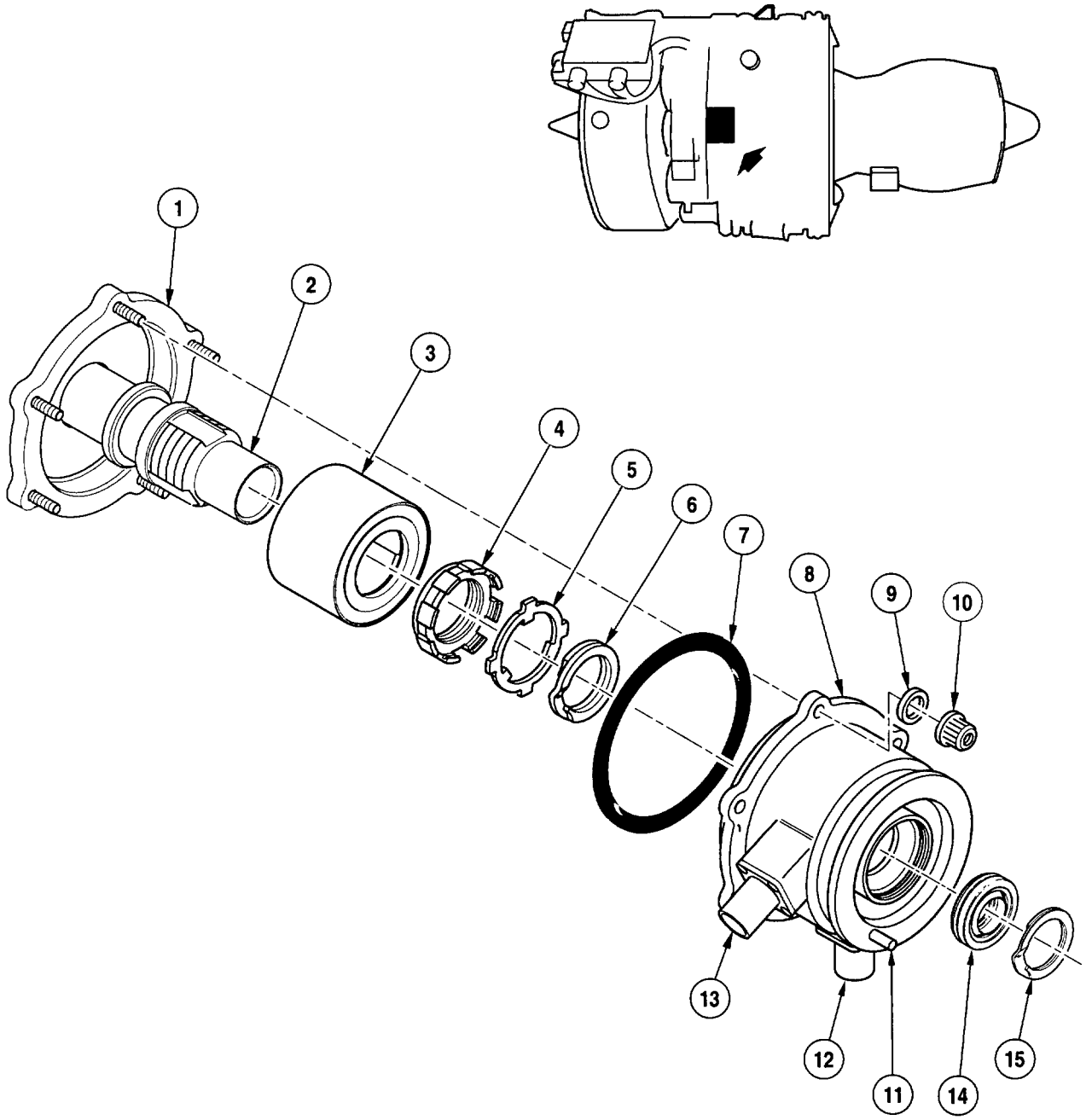
(5) Align the mandrel to the end of the gearshaft

CAUTION: MAKE SURE THE SEAL IS PUSHED STRAIGHT, NOT ON AN ANGLE.

(6) Push seal (14) off the mandrel on the shaft.

(7) Remove the mandrel while holding seal in place. Discard the mandrel.

(8) Seat the seal with seal pusher (PWC60685). Torque seal pusher 50 to 60 lb.in. (5.6-6.7 Nm). Turn seal pusher 180 degrees and reapply torque 50 to 60 lb.in. (5.6-6.7 Nm).



C31315B

PMA Removal/Installation
Figure 202

Key to Figure 202

1. Accessory Gearbox (Ref.)
2. Fuel Pump Gearshaft (Ref.)
3. Rotor
4. Retaining Nut
5. Keywasher
6. Retaining Ring
7. Preformed Packing
8. PMA Housing
9. Washer
10. Self-locking Nut
11. Locating Pin (Ref.)
12. Connector P12
13. Connector P11
14. Seal
15. Retaining Ring

CAUTION: MAKE SURE THAT THE SEAL IS SEATED BELOW THE RETAINING RING GROOVE.

CAUTION: MAKE SURE THAT THERE IS NO TEARING OF THE WIPER OR THAT THE RUBBER HAS NOT BEEN SUFFICIENTLY DEFORMED TO OBSTRUCT THE RETAINING RING GROOVE.

(9) Remove teflon installation ring from the retaining ring groove.

(10) Remove any excess material that may have been shaved off the seal casing during installation.

(11) Install retaining ring (15).

(12) As required, install the HMU (Ref. Chapter 73-20-01, HYDROMECHANICAL METERING UNIT - MAINTENANCE PRACTICES).

E. PMA Installation (Ref. Fig. 202)

CAUTION: BE SURE THE OIL SEAL (14) HAD BEEN REMOVED FROM THE HOUSING, PRIOR TO THE HOUSING INSTALLATION.

(1) Install PMA rotor (3) on fuel pump gearshaft (2).

(2) Lubricate threads and mating face of retaining nut (4) with engine oil (PWC03-001) and install on fuel pump gearshaft (2).

CAUTION: SOCKET (PWC43161) HAS A TWO INCH OFFSET. REFER TO CHAPTER 70-00-00, STANDARD PRACTICES - MAINTENANCE PRACTICES FOR RECALCULATION OF TORQUE VALUES.

(3) Torque 600 to 800 lb.in. (67.8 to 90.4 Nm.) using socket (PWC43553) and adapter (PWC60144).

(4) Loosen nut to 0 lb.in. (0 Nm.).

(5) Torque 600 to 800 lb.in. (67.8 to 90.4 Nm.) using socket (PWC43553) and adapter (PWC60144).

(6) Install keywasher (5) and retaining ring (6) on retaining nut (4).

(7) Install new preformed packing (7) on PMA housing (8).

(8) Install PMA housing (8) over rotor (3).

NOTE: Position locating pin (11) at bottom.

(9) Attach PMA housing (8) with five washers (9) and five self-locking nuts (10). Torque 32 to 36 lb.in. (3.6-4.0 Nm.).

(10) Install the oil seal (14) and retaining ring (15) (Ref. Para. C. or D.).

(11) Install the HMU (Ref. Chapter 73-20-01, HYDROMECHANICAL METERING UNIT - MAINTENANCE PRACTICES).

CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN CONNECTING ELECTRICAL CONNECTORS.

CAUTION: MAKE SURE CONNECTOR PLUGS ARE FREE FROM MOISTURE; IF NECESSARY, DRY USING HEAT GUN.

CAUTION: PROPER PIN ENGAGEMENT SHOULD BE ACHIEVED BY HAND TIGHTENING. CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY THE BLUE COLOR AND IS VISIBLE; RED COLOR BAND MUST NOT BE VISIBLE.

(12) Attach wiring harness connector P12 to housing connector (13) and harness connector P11 to housing connector (12). Torque connectors 21 to 26 lb.in. (2.4-2.4 Nm.) using wrench (PWC60142-100).

(13) Post-SB24507 or Post-SB24372: Apply electrical insulation tape to connectors (Ref. Chapter 70-00-00, STANDARD PRACTICES - REMOVAL/INSTALLATION).

(14) Restore electrical power to appropriate system and reset EEC circuit breaker to ON.

(15) Select maintenance discrete OFF.

(16) Refer to Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST for checks following installation of AC generator.

9. Alternator or Starter Oil Seal

A. Removal of Alternator or Starter Oil Seal (Ref. Fig. 201)

(1) Remove alternator or starter to gain access to oil seal (Ref. Aircraft Maintenance Manual).

(2) Visually check inside of the starter shaft using a flashlight, for evidence of oil.

(3) If there is no evidence of oil, proceed to step (6).

(4) If there is evidence of oil after doing step (5), proceed to Para. B..

(5) If there is evidence of oil, proceed as follows:

(a) Clean inside of gearshaft using petroleum solvent (PWC11-027).

(b) Install starter (Ref. Aircraft Maintenance Manual).

(c) Run engine at take-off power (Ref. Ch. 71-00-00, ADJUSTMENT/TEST), stabilize for three minutes and shut down engine.

(d) Repeat steps (1) thru (3).

(6) Remove retaining ring (2) (Ref. Section D-D).

(7) Pre-SB24303:

(a) Cut seal (1) using suitable knife.

(b) Remove seal (1) using extractor (PWC60295).

(8) Post-SB24303:

(a) Cut seal (1) using suitable knife.

(b) Remove seal (1) using extractor (PWC60679).

CAUTION: DO NOT ALLOW DEBRIS TO FALL INSIDE AGB.

(c) Check for teflon residue on gearshaft and remove if necessary using abrasive cloth (PWC05-014).

(d) Clean gearshaft with isopropyl alcohol (PWC11-014B).

B. Application of Sealant to Inside of Alternator or Starter Gearshaft (Ref. Fig. 203)

CAUTION: MAKE SURE THE INSIDE OF THE GEARSHAFT IS CLEAN AND DRY SO THE SEALANT WILL ADHERE PROPERLY.

(1) If required, drain the accessory gearbox (Ref. 72-00-00, SERVICING).

(2) Remove all engine oil from the interior of the gearshaft and dry with isopropyl alcohol (PWC11-014B).

(3) Apply sealant (PWC09-017) or (PWC09-017A) as shown.

(4) Allow the sealant to cure in accordance with the manufacturers instructions.

C. Installation of Alternator or Starter Oil Seal (Pre-SB24303) (Ref. Fig. 201)

(1) Remove all engine oil from AGB gearshaft and dry with isopropyl alcohol (PWC11-014B).

NOTE: A clean and dry gearshaft will result in better seating of the oil seal that occurs during initial engine run.

(2) Apply a layer of engine oil (PWC03-001) to pilot (PWC60224) (Ref. Area E) and seal (1).

(3) Fit seal (1 or 3) on pilot as indicated. Take note of direction of seal lips.

(4) Position seal/pilot combination in seal housing and push seal (1 or 3) onto shaft by hand. Remove pilot (PWC60224).

CAUTION: MAKE SURE THAT THE SEAL IS SEATED BELOW THE RETAINING RING GROOVE.

CAUTION: MAKE SURE THAT THERE IS NO TEARING OF THE WIPER OR THAT THE WIPER HAS COME OUT OF THE SEAL.

(5) Install seal with drift (PWC60225-03).

(6) Remove excess material that may have been shaved off the seal casing during installation.

(7) Install retaining ring (2 or 4).

(8) Install alternator or starter (Ref. Aircraft Maintenance Manual).

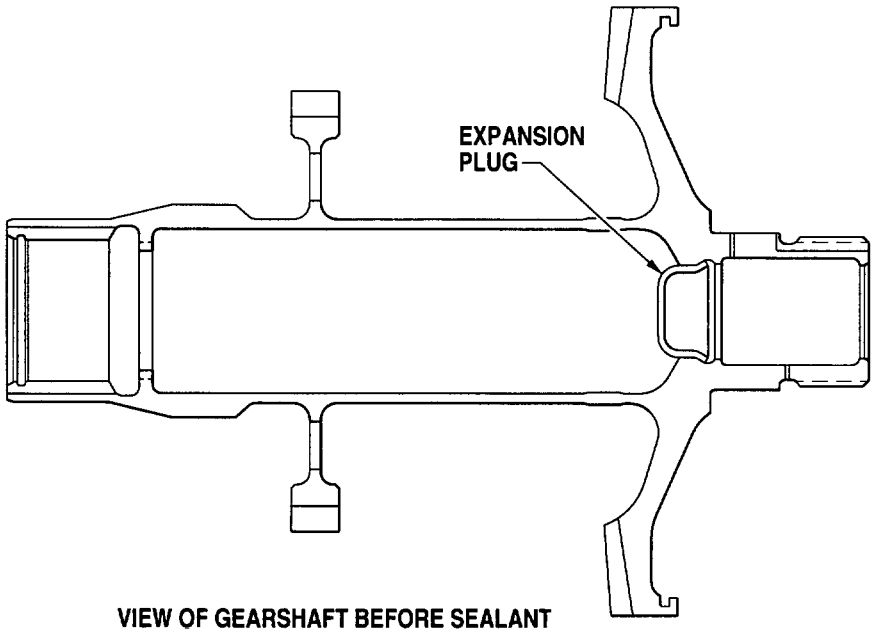
D. Installation of Alternator or Starter Oil Seal (Post-SB24303 or Post-SB24330) (Ref. Fig. 201)

(1) Clean the gearshaft, where the seal lip will touch, with isopropyl alcohol (PWC11-014B) before installing the seal.

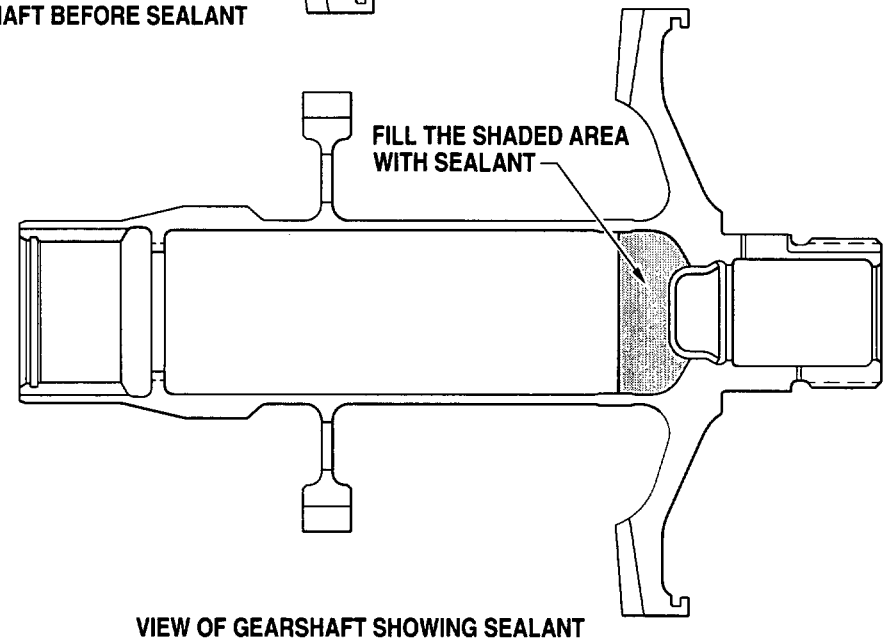
NOTE: A clean and dry gearshaft will result in better seating of the oil seal that occurs during initial engine run.

(2) Install the teflon installation ring (supplied with seal) in the retaining ring groove in the housing.

NOTE: Make sure that the retaining ring groove is free and clear of any damage and that there is no raised material before installing the teflon ring.



VIEW OF GEARSHAFT BEFORE SEALANT



VIEW OF GEARSHAFT SHOWING SEALANT

C72285

Application of Sealant to Inside of Gearshaft
Figure 203

WARNING: READ SUPPLIER'S MATERIAL SAFETY DATA SHEET BEFORE USING ASSEMBLY FLUID NO (PWC06-13).

CAUTION: DO NOT REMOVE THE MANDREL FROM THE SEAL.

(3) Apply a thin layer of assembly fluid mixture (PWC06-13) to the outer surface of the seal (1).

(4) Make sure the seal (1) orientation on the mandrel is correct.

NOTE: The beige colored seal lip must face out towards retaining ring groove (5). Align the mandrel to the end of the gearshaft.

CAUTION: MAKE SURE THE SEAL IS PUSHED STRAIGHT, NOT ON AN ANGLE.

(5) Push seal (1) off the mandrel onto the shaft.

(6) Remove the mandrel while holding seal (1) in place. Discard the mandrel.

(7) Seat the seal (1) with seal pusher (PWC60682). Torque seal pusher 50 to 60 lb.in. (5.6- 6.7 Nm).

CAUTION: MAKE SURE THAT THE SEAL IS SEATED BELOW THE RETAINING RING GROOVE.

CAUTION: MAKE SURE THAT THERE IS NO TEARING OF THE WIPER OR THAT THE RUBBER HAS NOT BEEN SUFFICIENTLY DEFORMED TO OBSTRUCT THE RETAINING RING GROOVE.

(8) Remove the teflon installation ring from the retaining ring groove.

(9) Remove any excess material that may have been shaved off the seal casing during installation.

(10) Install retaining ring (2).

(11) Install alternator or starter (Ref. Aircraft Maintenance Manual).

10. Cold Start Valve

A. Removal (Ref. Fig. 204)

(1) Remove nut (1) and bolt (2) from oil pressure tube clamp (3).

(2) Disconnect tube coupling nuts (4 and 5).

(3) Remove two bolts (6) securing oil pressure tube (7) to outer bypass duct.

(4) Remove oil pressure tube (7). Remove and discard preformed packing (8).

(5) Remove two bolts (9) securing oil pressure tube (10) to accessory gearbox.

(6) Remove oil pressure tube (10). Remove and discard preformed packing (11).

(7) Remove two bolts (12) securing bracket (13) (Pre-SB24011) or (23) (Post-SB24011) to accessory gearbox. Remove bracket (13) (Pre-SB24011) or (23) (Post-SB24011).

WARNING: SPRING (18) IS UNDER COMPRESSION. TO PREVENT INJURY WHEN REMOVING COVER (16) LOOSEN TWO BOLTS (14) GRADUALLY ALTERNATIVELY FROM ONE BOLT TO OTHER.

(8) Remove two bolts (14) and washers (15).

(9) Remove cover (16). Remove and discard preformed packing (17).

(10) Remove spring (18) and valve (19).

(11) Install puller (PWC43125) and remove valve housing (20) from accessory gearbox. Remove and discard preformed packings (21 and 22).

B. Installation (Ref. Fig. 204)

(1) Lubricate and install two new preformed packings (21 and 22) on valve housing (20).

(2) Install valve housing (20) into accessory gearbox.

(3) Insert valve (19) into valve housing (20).

(4) Insert spring (18) into valve (19).

(5) Lubricate and install one new preformed packing (17) on cover (16).

(6) Install cover (16) and secure using two bolts (14) and washers (15). Tighten bolts gradually alternatively from one bolt to the other. Torque bolts 36 to 40 lb.in. (4.0-4.6 N.m).

(7) Position bracket (13) (Pre-SB24011) or (23) (Post-SB24011) and secure to accessory gearbox using two bolts (12). Torque bolts 36 to 40 lb.in. (4.0-4.6 N.m).

(8) Lubricate and install one new preformed packing (11) on oil pressure tube (10).

(9) Install oil pressure tube (10) on accessory gearbox and secure using two bolts (9). Torque bolts 36 to 40 lb.in. (4.0-4.6 N.m).

(10) Lubricate and install one new preformed packing (8) on oil pressure tube (7).

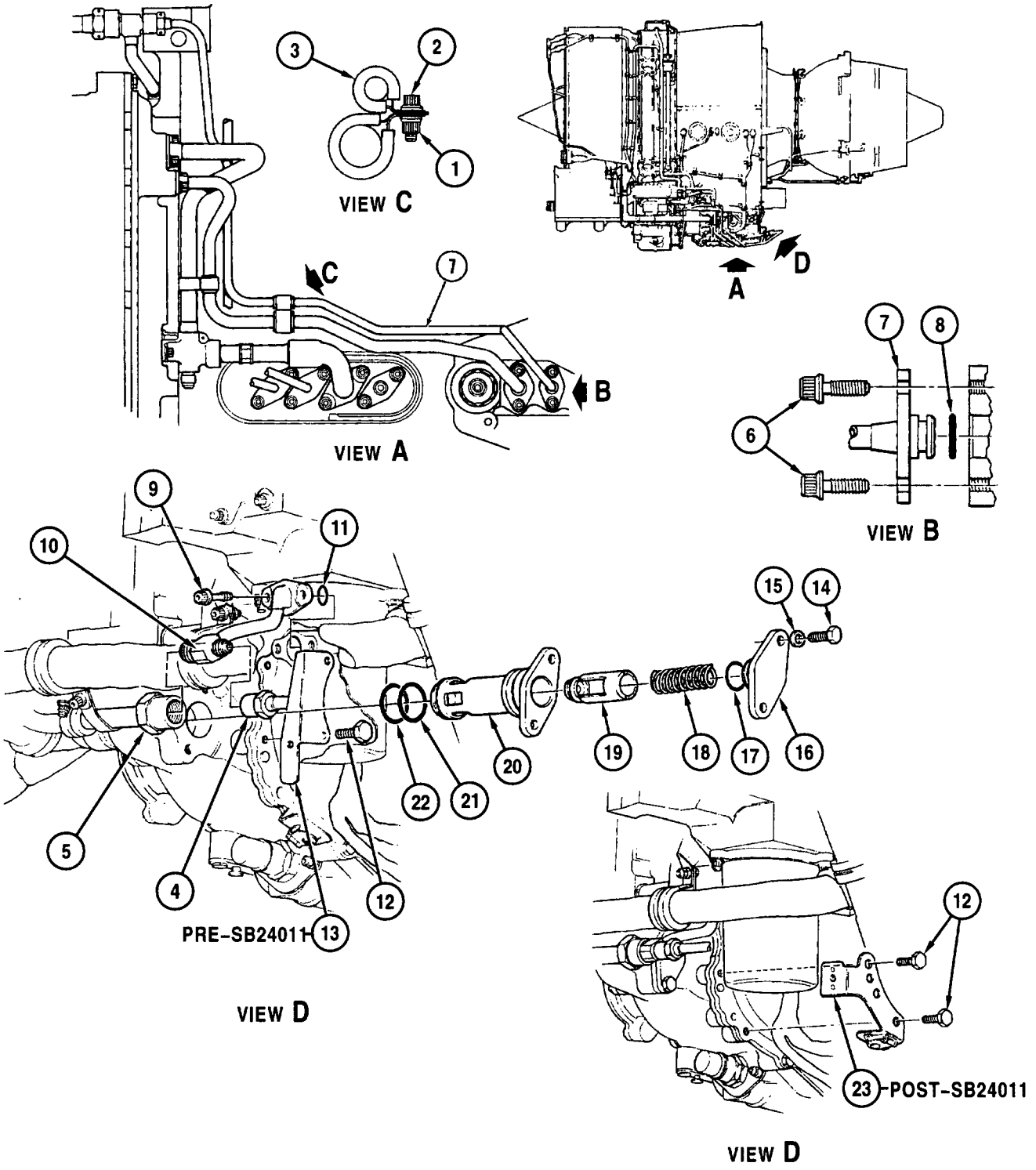
(11) Install oil pressure tube (7) on outer bypass duct using two bolts (6). Torque bolts 20 to 30 lb.in. (2.3-3.4 N.m).

(12) Connect tube coupling nuts (4 and 5).

CAUTION: HOLD OIL PRESSURE TUBE (10) AT TEE-PIECE WHEN TORQUING TUBE COUPLING NUTS (4 AND 5).

(13) Torque tube coupling nut (4) 90 to 100 lb.in. (10-11 N.m).

(14) Torque tube coupling nut (5) 450 to 500 lb.in. (50-56 N.m).



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Cold Start Valve Removal/Installation
Figure 204

Key to Figure 204

1. Self-locking Nut
2. Bolt
3. Tube Clamp
4. Tube Coupling Nut
5. Tube Coupling Nut
6. Bolt
7. Oil Pressure Tube
8. Preformed Packing
9. Bolt
10. Oil Pressure Tube
11. Preformed Packing
12. Bolt
13. Bracket (Pre-SB24011)
14. Bolt
15. Washer
16. Cover
17. Preformed Packing
18. Spring
19. Valve
20. Valve Housing
21. Preformed Packing
22. Preformed Packing
23. Bracket (Post-SB24011)

(15) Lockwire tube coupling nut (4) to tube coupling nut (5) using lockwire (PWC05-089).

CAUTION: DO NOT LUBRICATE THREADS.

(16) Position tube clamp (3) and secure using self-locking nut (1) and bolt (2). Torque 27 to 30 lb.in. (3.0 - 3.4 N.m).

11. Accessory Gearbox

A. Removal from Engine (Ref. Fig. 205)

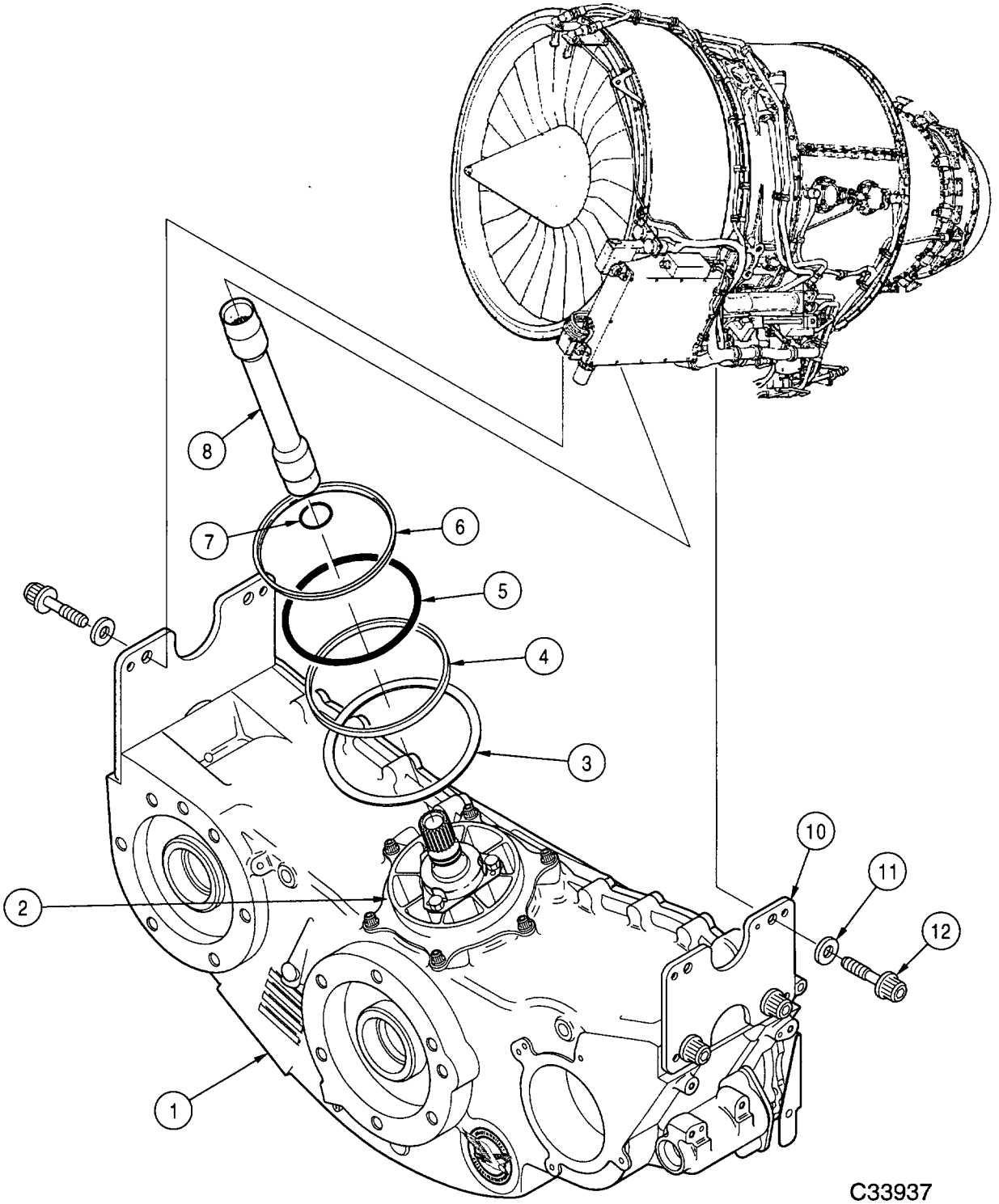
(1) Drain oil system completely (Ref. 72-00-00, SERVICING).

(2) Remove starter-generator, hydraulic pump and any other applicable airframe supplied accessories (Ref. Aircraft Maintenance Manual).

(3) Disconnect tubes from fuel filter housing.

(4) Remove HMU (Ref. 73-20-01).

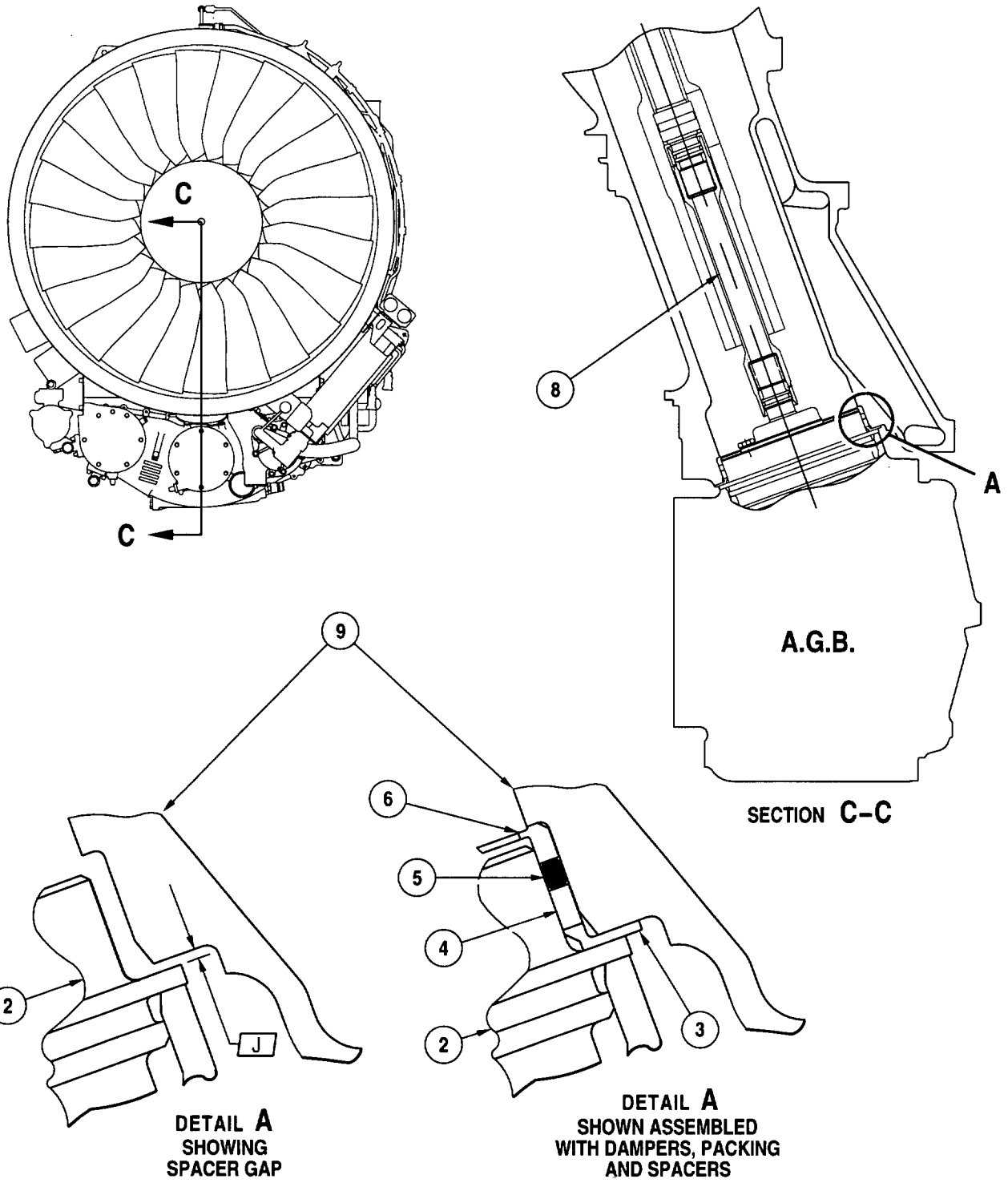
(5) Remove fuel/oil heat exchanger (Ref. 79-20-02).



Accessory Gearbox - Removal/Installation
Figure 205 (Sheet 1 of 2)

Key to Figure 205

1. Accessory Gearbox Assembly
2. Adapter Assembly
3. Spacer
4. Lower Damper Vibration Ring
5. Preformed Packing
6. Upper Vibration Damper Ring
7. Preformed Packing
8. Coupling Shaft
9. Intermediate Case
10. Mounting Plate
11. Washer
12. Bolt



C33914

Accessory Gearbox - Removal/Installation
Figure 205 (Sheet 2)

(6) Remove oil pump transfer tube retaining plate (Ref. 79-20-05).

(7) Disconnect AGB oil pressure tube assembly (Ref. 79-20-04).

(8) Remove scavenge oil tubes (Ref. 79-20-03).

(9) Remove AGB from engine as follows (Ref. Fig. 205):

(a) Support AGB (1), and remove eight bolts (12), washers (11) and two mounting plates (10).

(b) Lower AGB (1) from the intermediate case (9) enough to access coupling shaft (8).

(c) Pry end of shaft (8) using nylon drift to remove shaft from adapter (2).

(d) Remove AGB (1) from intermediate case (9).

(e) Remove and discard damper vibration rings (4, 6) and preformed packing (5). Remove spacer (3).

(f) Removed and discard preformed packing (7) from input drive shaft (8).

B. Installation on Engine (Ref. Fig. 205 and 206)

(1) If the same AGB is being installed on the engine go to step (7).

(2) Install AGB on engine without spacer (3, Fig. 205), packing (7) and damper vibration rings (4, 6). Secure with two mounting plates (10) eight, washers (11) and eight bolts (12). Do not torque bolts.

(3) Measure and record dimension J (Ref. Fig. 205, Sht. 2) between the adapter and intermediate case at three places.

(4) The necessary spacer thickness is dimension J minus 0.004 inch.

(5) Remove AGB from engine by supporting AGB (1) then remove eight bolts (12), washers (11) and two mounting plates (10).

CAUTION: DO NOT MIX PRE AND POST-SB24093 ADJUSTING SPACERS.

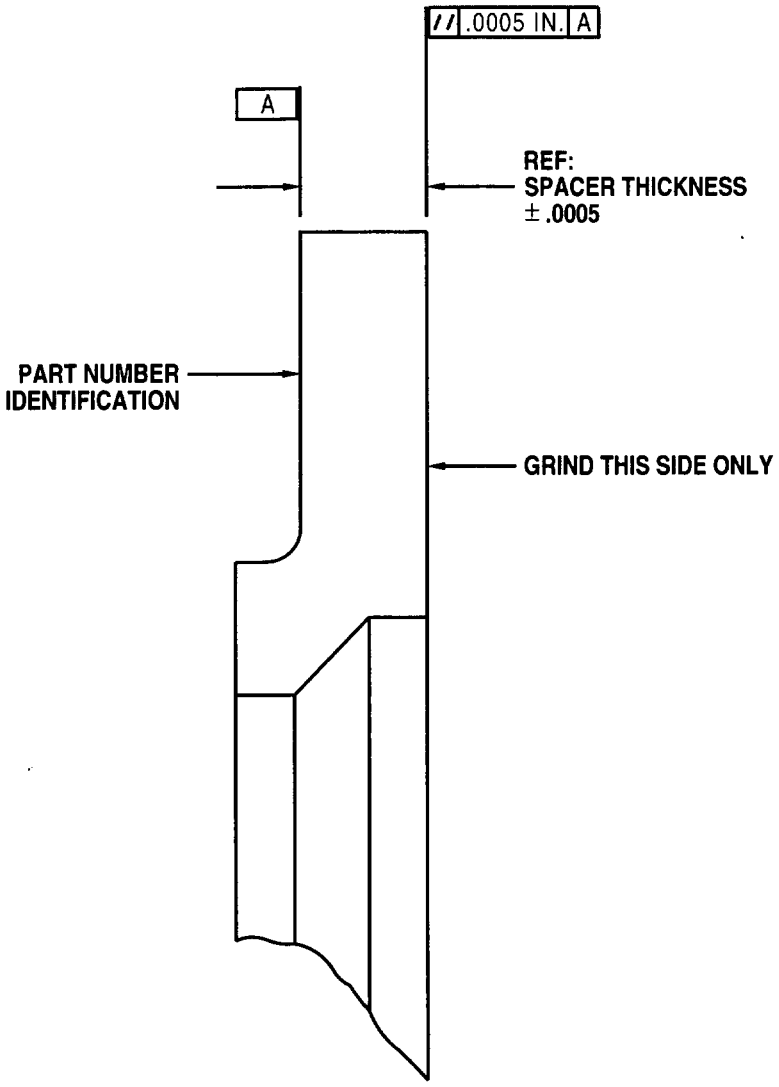
(6) If a spacer (3) of necessary thickness is not available, grind a new or existing spacer to the necessary spacer thickness ± 0.0005 (Ref. Fig. 206) as follows:

(a) Do not grind datum surface A. Grind spacer on largest surface area only.

(b) Machined surface must be parallel with datum surface A within 0.0005 inch.

(c) Break sharp edges 0.003 to 0.015 inch (0.08-0.38 mm).

(d) Spray wash spacer using petroleum solvent.



C33915

Grinding of Spacer
Figure 206

CAUTION: INSTALL LARGEST SURFACE AREA OF SPACER TOWARDS AGB.

(7) Install spacer (3, Fig. 205), lower vibration damper ring (4), preformed packing (5) and upper vibration damper ring (6).

(8) Lubricate and install one new preformed packing (7) on the input drive shaft of adapter assembly (2).

(9) Lubricate splines of coupling shaft (8) and input drive shaft on adapter assembly (2) with engine oil (PWC03-001).

(10) Install AGB (1), two mounting plates (10), eight washers (11) and eight bolts (12). Torque 85 to 95 lb.in. (9.5-11.0 N.m).

(11) Check gap between spacer (3) and intermediate case (9). Dimension must be 0.0035 inch (0.089 mm) minimum to 0.0045 inch (0.114 mm) maximum.

(12) Install scavenge oil tube (Ref. 79-20-03).

(13) Connect AGB oil pressure tube assembly (Ref. 79-20-04).

(14) Install oil pump transfer tube retaining plate (Ref. 79-20-05).

(15) Install fuel/oil heat exchanger (Ref. 79-20-02).

(16) Install HMU (Ref. 73-20-01).

(17) Install Starter-generator, hydraulic pump and any other applicable airframe supplied accessories (Ref. Aircraft Maintenance Manual).

(18) Fill oil system (Ref. 72-00-00, SERVICING).

(19) Ground run engine per check Nos. 1, 2, 3 and 5 (Ref. 71-00-00 ADJUSTMENT/TEST).

(20) Perform static leak check for oil leaks.

12. Engine Identification and Trim Plates

A. Removal (Ref. Fig. 207)

(1) Remove head of four rivets (3) using a 0.125 inch diameter drill.

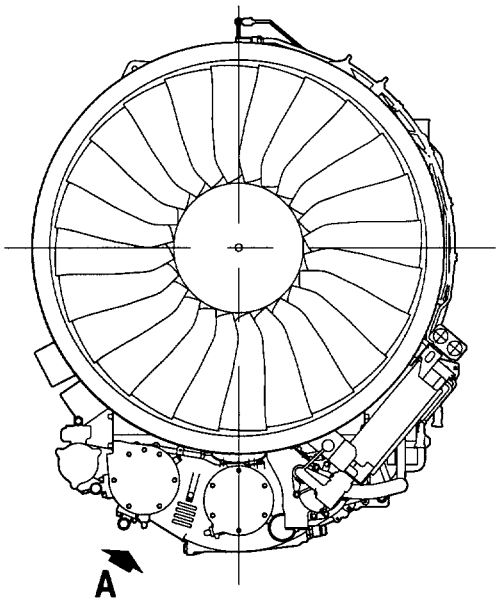
(2) Using a suitable punch, light tap the rivet stem through the trim plate (5) and identification plate (4) until the plate is free.

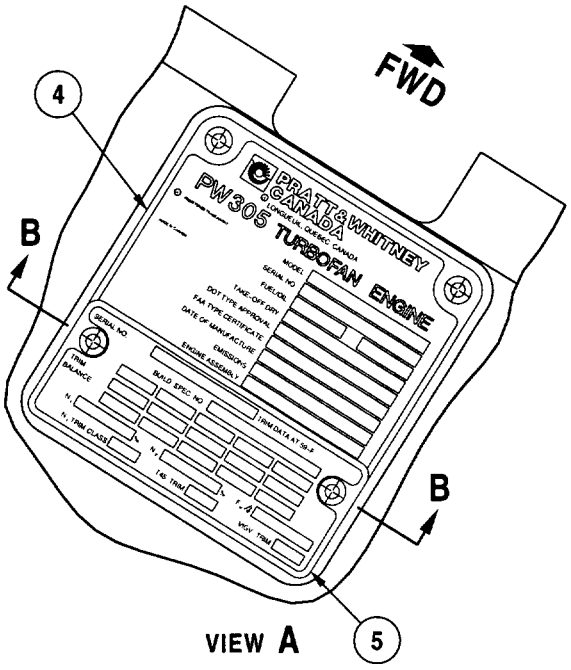
(3) Remove four screws (2) and retaining plate (1).

(4) Remove wasted portion of rivets (3) from cavities in accessory gearbox housing.

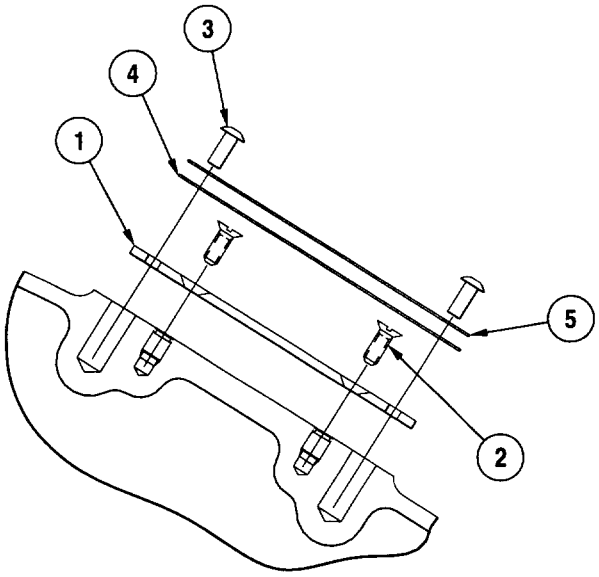
B. Installation (Ref. Fig. 207)

(1) Secure retaining plate (1) to AGB with four screws (2). Torque screws 9 to 11 lb.in. (1.0-1.2 N.m).





VIEW A



SECTION B-B

C33936

Engine Identification and Trim Plate - Removal/Installation
Figure 207

Key to Figure 207

1. Retaining Plate
2. Screw
3. Rivet
4. Engine Identification Plate
5. Trim Plate

(2) Install identification plate (4) on retaining plate (1). Put trade mark on identification plate forward. Secure with two blind rivets (3) in the front corners using suitable riveting tool.

(3) Install trim plate (5) over bottom portion of identification plate (4) and make sure no information is obscured. Secure with two blind rivets (3) using suitable tool.

(4) Cut and file rivet stems flush to head. Do not push rivet stem inside AGB case.

13. Fits, Clearances and Torque Loadings

TABLE 201, Fits and Clearances

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
14	Pre-SB24303 Housing, Accessory Gearbox	1.8745 (47.612)	1.8755 (47.638)	0.0025T (0.064T)	0.0075T (0.191T)	
	Seal, Plain	1.8780 (47.702)	1.8820 (47.803)			
14	Post-SB24303 Housing, Accessory Gearbox	1.8745 (47.612)	1.8755 (47.638)	0.0135T (0.343T)	0.0245T (0.622T)	
	Seal, Plain	1.889 (47.981)	1.899 (47.235)			
24	Cover, Accessory Gearbox	1.580 (40.132)	1.581 (40.157)	0.0015T (0.038T)	0.0035T (0.089T)	
	Bearing, Plain	1.5825 (40.195)	1.5835 (40.221)			
26	Pre-SB24303 Cover Assy-AGB	1.6795 (42.659)	1.6805 (42.685)	0.0035T (0.089T)	0.0125T (0.318T)	
	Seal-plain	1.684 (42.774)	1.692 (42.977)			

TABLE 201, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
26	Post-SB24303 Cover Assy-AGB	1.6795 (42.659)	1.6805 (42.685)	0.0145T (0.368T)	0.0255 (0.648)	
	Seal-plain	1.695 (43.053)	1.705 (43.307)			
29	Pre-SB24303 Adapter, Breather	1.375 (34.925)	1.376 (34.95)	0.003T (0.076T)	0.000 (0.000)	
	Seal, Face	1.376 (34.95)	1.378 (35.001)			
29	Post-SB24303 Adapter, Breather	1.374 (34.900)	1.376 (34.95)	0.015T (0.381T)	0.026 (0.660)	
	Seal, Face	1.391 (35.331)	1.400 (35.560)			
30	Cover, Accessory Gearbox	1.696 (43.078)	1.699 (43.155)	0.001 (0.025)	0.006 (0.152)	
	Adapter, Breather	1.693 (43.003)	1.695 (43.053)			
31	Cover, Accessory Gearbox	3.5395 (89.903)	3.5405 (89.929)	0.0001 (0.003)	0.0021 (0.053)	
	Stator & Housing, AC Generator	3.5384 (89.876)	3.5394 (89.900)			
32	Pre-SB24303 Stator & Housing, AC Generator	1.374 (34.90)	1.376 (34.95)	0.002T (0.051T)	0.009T (0.229T)	
	Seal, Plain	1.378 (35.001)	1.383 (35.129)			
32	Post-SB24303 Stator & Housing, AC Generator	1.374 (34.90)	1.376 (34.95)	0.015T (0.381T)	0.026T (0.660T)	
	Seal, Plain	1.391 (35.331)	1.400 (35.560)			

TABLE 201, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
63	Housing, Accessory Gearbox	1.129 (28.60)	1.131 (28.652)	0.001 (0.025)	0.005 (0.127)	
	Valve Assembly, Cold Start	1.126 (28.677)	1.128 (28.727)			
64	Housing, Accessory Gearbox	1.184 (30.074)	1.187 (30.15)	0.001 (0.025)	0.006 (0.152)	
	Valve Assembly Cold Start	1.181 (29.998)	1.183 (30.049)			

TABLE 202, Torque and Stretch

REF. NO.	Name	Limits Min.	Limits Max.
	Not applicable		

TABLE 203, Spring Pressures

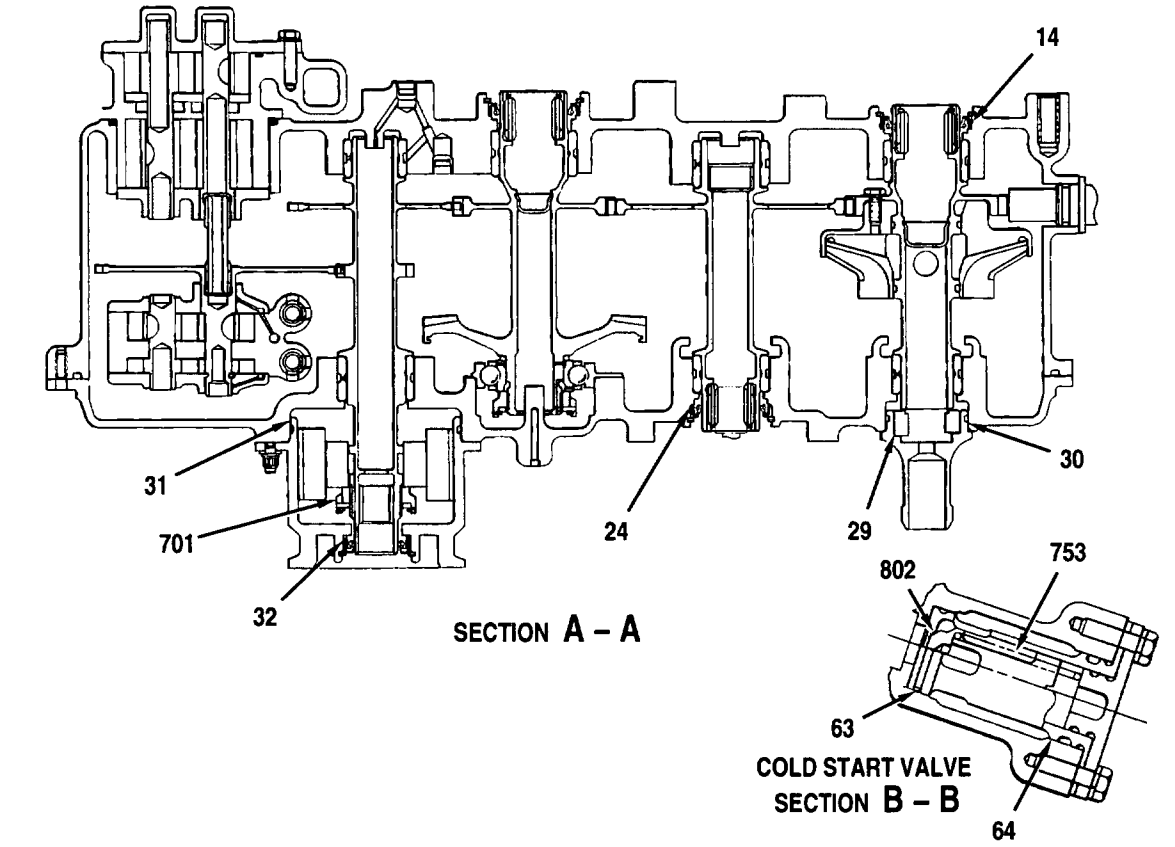
REF. NO.	Name	Limits Min.	Limits Max.
753	Pre-SB24079 Spring, Cold Start Valve		
	At length1.750 (44.450)	33 lb 4 oz (148.3N)	34 lb 2 oz (152.2N)
	At length1.550 (39.370)	41 lb 9 oz (185.3N)	43 lb 5 oz (193.1N)
753	Post-SB24079 Spring, Cold Start Valve		
	At length2.688 (68.275)	8 lb 15 oz (39.9N)	10 lb 7 oz (46.5N)
	At length1.788 (45.415)	37 lb 5 oz (166.4N)	40 lb 5 oz (179.8N)

TABLE 204, Special Assembly Procedures

REF. NO.	Name	Limits Min.	Limits Max.
701	Nut, AC Generator Bearing Retaining		
	(1) Lubricate with engine oil (PWC03-001) and tighten 600 to 800 lb.in. (67.8 to 90.4 N.m).		
	(2) Loosen to zero, and retighten to 600 to 800 lb.in. (67.8 to 90.4 N.m).		
802	Lapping Procedure (Pre-SB24079)		
	(1) This surface must be lapped with mating part using clean engine oil (PWC03-001). No leakage permitted when exposed to 150 to 170 psig (1035 to 1170 kPa) oil. Valve cracking pressure of 190 to 220 psig (1310 to 1519 kPa) required. Must be checked by pressure test.		
802	Lapping Procedure (Post-SB24079)		
	(1) This surface to be lapped if necessary, to obtain 360° surface contact with mating part. Must not leak when exposed to 150 to 170 psig (1035 to 1170 kPa) oil. Valve cracking pressure of 239 to 272 psig (1650 to 1875 kPa) required. Must be checked by pressure test.		

TABLE 205, Backlash

REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		



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Accessory Gearbox - Fits, Clearances and Torque Loadings
Figure 208

TABLE OF CONTENTS

SUBJECT	PAGE
BYPASS DUCTS - DESCRIPTION AND OPERATION	**72-70-00**
1. General	1
2. Inner Bypass Duct)	1
3. Outer Bypass Duct)	1
BYPASS DUCTS - MAINTENANCE PRACTICES	**72-70-01**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Outer Bypass Duct	201
A. Removal of Upper Section	201
B. Installation of Upper Section	207
C. Removal of Lower Section	207
D. Removal of Flanged Couplings and Blanking Plates on Outer Bypass Duct (Lower Section)	212
E. Installation of Lower Section	213
F. Installation of Flanged Couplings and Blanking Plates on Outer Bypass Duct (Lower Section)	217
6. Inner Bypass Duct	218
A. Removal of Upper Section (Pre-SB24441)	218
B. Removal of Inner Bypass Duct (upper section) (Post-SB24441)	218
C. Installation of Upper Section (Pre-SB24441)	218
D. Installation of Inner Bypass Duct (Upper Section) (Post-SB24441)	219
E. Installation of Inner Bypass Duct (Upper Section) (Post-SB24441 and Post-SB24489)	219
F. Removal of Lower Section (Pre-SB24441)	220
G. Removal of Lower Section (Post-SB24441)	226

TABLE OF CONTENTS

SUBJECT	PAGE
BYPASS DUCTS - MAINTENANCE PRACTICES (Cont'd)	**72-70-01**
H. Removal of Lower Section (Post-SB24441 and Post-SB24489)	226
I. Installation of Lower Section (Pre-SB24441)	227
J. Installation of Inner Bypass Duct (Lower Section) (Post-SB24441)	229
K. Installation of Inner Bypass Duct (Lower Section) (Post-SB24441 and Post-SB24489)	231
7. Inner Bypass Duct Fairings	233
A. Application of Sealant	233
8. Inspection/Check	233
A. Visual Check	233

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	May 30/2008
	2 blank	May 30/2008
Contents	1	May 30/2008
	2	May 30/2008
72-70-00	1	Nov 19/99
Description and	2	Nov 19/99
Operation	3	Nov 19/99
	4 blank	Nov 19/99
72-70-01	201	May 30/2008
Maintenance	202	May 30/2008
Practices	203	May 30/2008
	204	May 30/2008
	205	May 30/2008
	206	May 30/2008
	207	May 30/2008
	208	May 30/2008
	209	May 30/2008
	210	May 30/2008
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	230	May 30/2008
	231	May 30/2008
	232	May 30/2008
	233	May 30/2008
	234	May 30/2008
	235	May 30/2008
	236	May 30/2008

BYPASS DUCTS - DESCRIPTION AND OPERATION

1. General

The engine bypass ducts consist of a two-piece annular outer assembly and a four-piece annular inner assembly. The outer assembly is secured to the rear outer flange of the intermediate case (Flange C), while the inner assembly is located with a snug fit to the inside diameter of the intermediate case, and is secured to the front flange of the combustion chamber case. An airframe-supplied fan duct and inner core cowl is secured to the rear flange of the outer and inner assemblies, respectively. The total configuration forms a full length bypass duct, through which bypass air is propelled.

2. Inner Bypass Duct (Ref. Fig. 1)

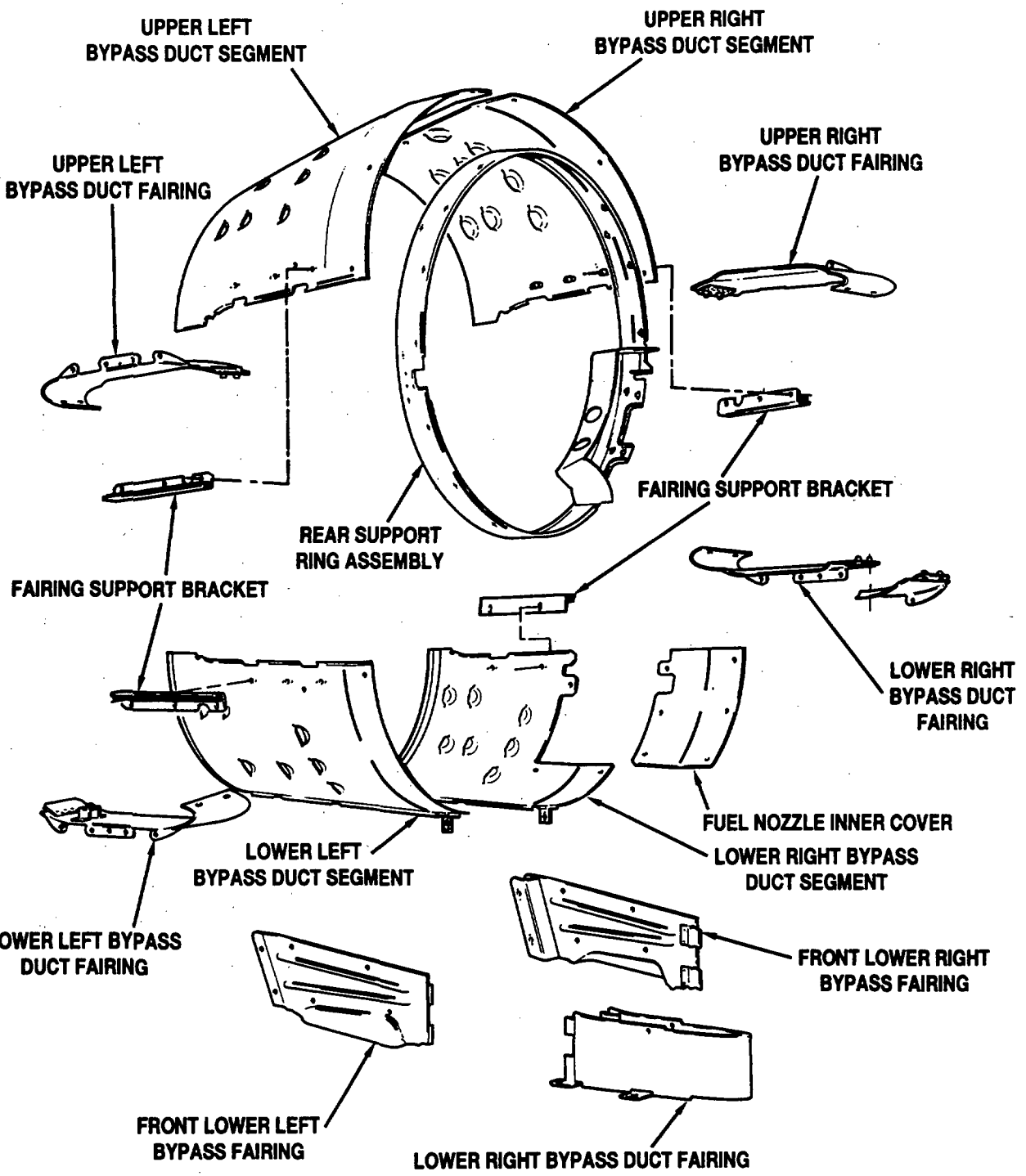
The inner bypass duct is an aluminum sheet metal assembly, comprising four main sections and three faired support-struts. A snug fit locates the front end of the bypass duct to the intermediate case, while a support ring, bolted to the rear flange of the gas generator case provides a rigid support midway along the length of the bypass duct. A stiffening ring, attached to the rear end of the bypass duct, adds rigidity and provides the attachment surface for the airframe-supplied core cowl.

A box-shaped section, fastened to the inside of the bypass duct at the rear end, provides thermal protection for the spark igniters and cables. A panel at about the 4 o'clock position provides access to the hybrid fuel nozzles.

The struts at the 3 and 9 o'clock positions provide passageways for the cabin bleed air pipes, while the strut at the 6 o'clock position houses fuel and oil transfer tubes and the emergency fuel shutoff cable.

3. Outer Bypass Duct (Ref. Fig. 2)

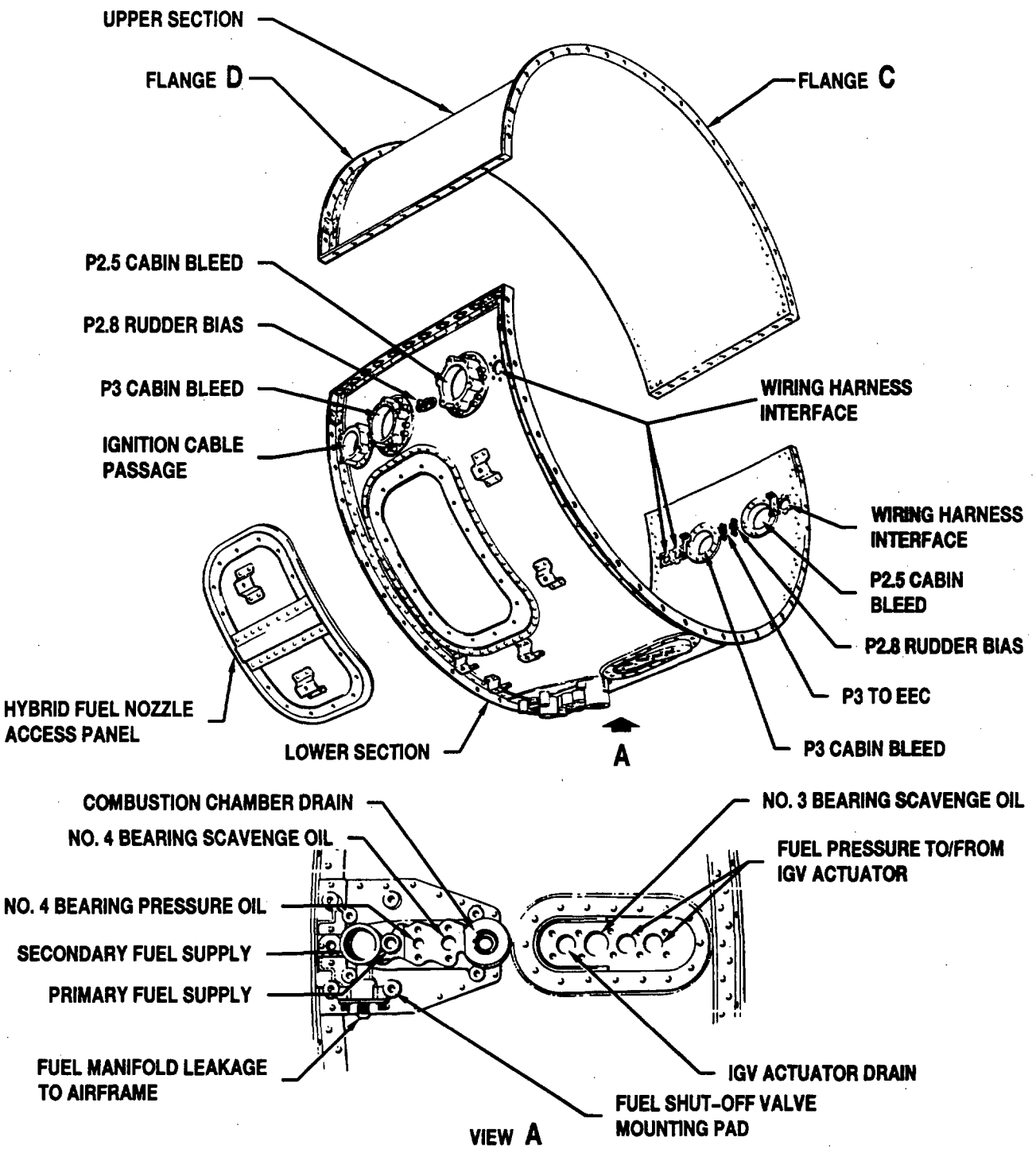
The outer bypass duct consists of a two-piece annular aluminum sheet metal assembly, with flanges at the front, rear and sides. The front flange is bolted to the rear outer face of the intermediate case (Flange C) and the rear flange (Flange D) provides the means of attachment for the airframe-supplied fan duct. Flanges at the 3 and 9 o'clock positions secure the two halves of the assembly together. An access panel located under the ignition exciter box mounts provides access to the inner bypass duct access panel, which allows access to the hybrid fuel nozzles. Various bosses around the circumference of the duct provide for accessories and external fittings.


UPPER LEFT BYPASS DUCT SEGMENT
UPPER RIGHT BYPASS DUCT SEGMENT
UPPER LEFT BYPASS DUCT FAIRING
UPPER RIGHT BYPASS DUCT FAIRING
FAIRING SUPPORT BRACKET
REAR SUPPORT RING ASSEMBLY
FAIRING SUPPORT BRACKET
LOWER RIGHT BYPASS DUCT FAIRING
FUEL NOZZLE INNER COVER
LOWER LEFT BYPASS DUCT SEGMENT
LOWER RIGHT BYPASS DUCT SEGMENT
LOWER LEFT BYPASS DUCT FAIRING
FRONT LOWER RIGHT BYPASS FAIRING
FRONT LOWER LEFT BYPASS FAIRING
LOWER RIGHT BYPASS DUCT FAIRING

ORIGINAL
As Received By
ATP

C19895

Inner Bypass Duct
Figure 1



ORIGINAL
As Received By
ATP

C19743

Outer Bypass Duct
Figure 2

BYPASS DUCTS - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces, with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC03-002	Fluid, Calibrating
PWC05-018	Pen, Marking
PWC05-020	Compound, Oil Base
PWC05-048	Pen, Marking
PWC05-089	Lockwire
PWC06-023	Compound, Antiseize
PWC09-003	Compound, Sealing
PWC09-019	Compound, Sealing
PWC11-002	Solvent

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Outer Bypass Duct

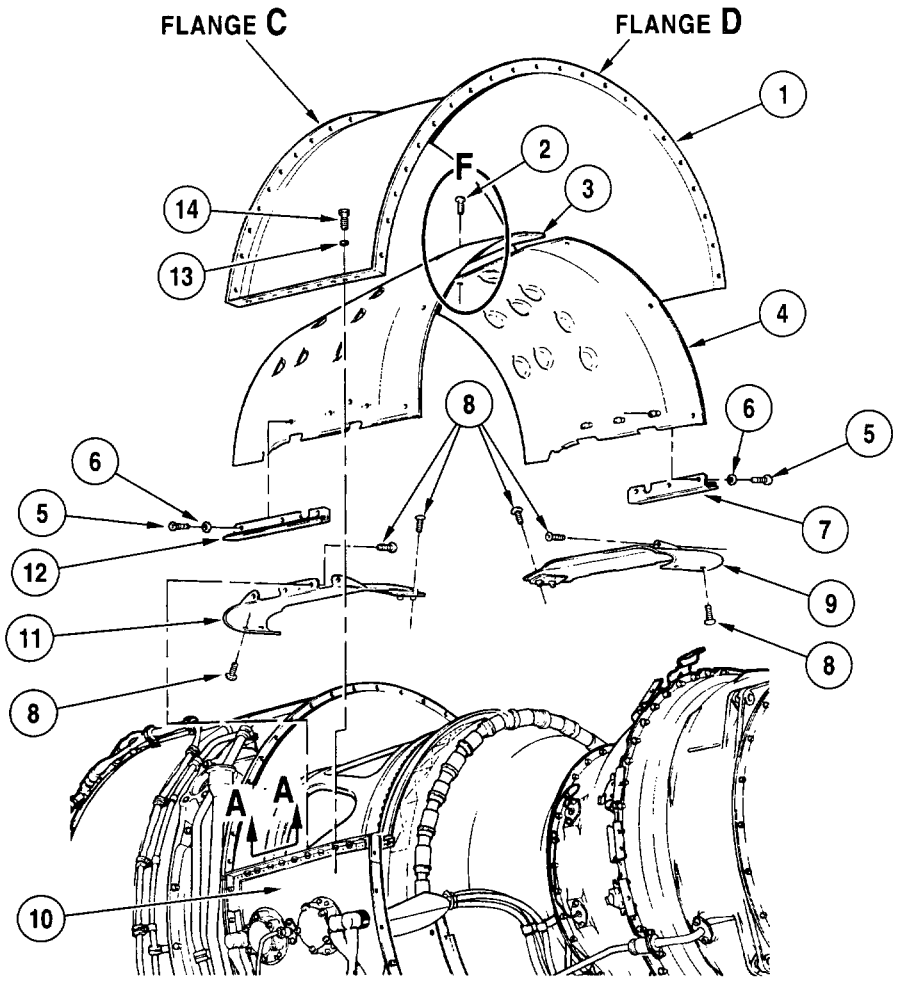
   A. Removal of Upper Section (Ref. Fig. 201)

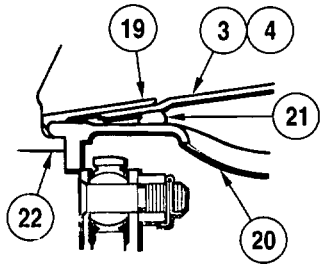
      (1) Remove all silicone rubber sealant (gray type) from the left hand and right hand fairings edges (Ref. Fig. 205).

      (2) Pre-SB24542 (PW305, PW305A and PW305B Engines):

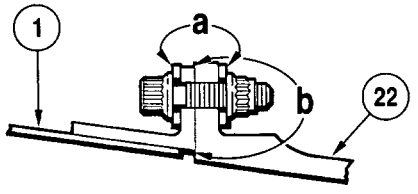
         (a) Remove 14 self-locking nuts (17), 21 bolts (15), bolt (18), brackets (23 and 24), 35 washers (16, Pre-SB24021) or 34 washers (16, Post-SB24021) and bracket (25, Post-SB24021) that attaches upper bypass duct (1) at Flange C.

      (3) Post-SB24542 (PW305A Engines Only):





SECTION A–A



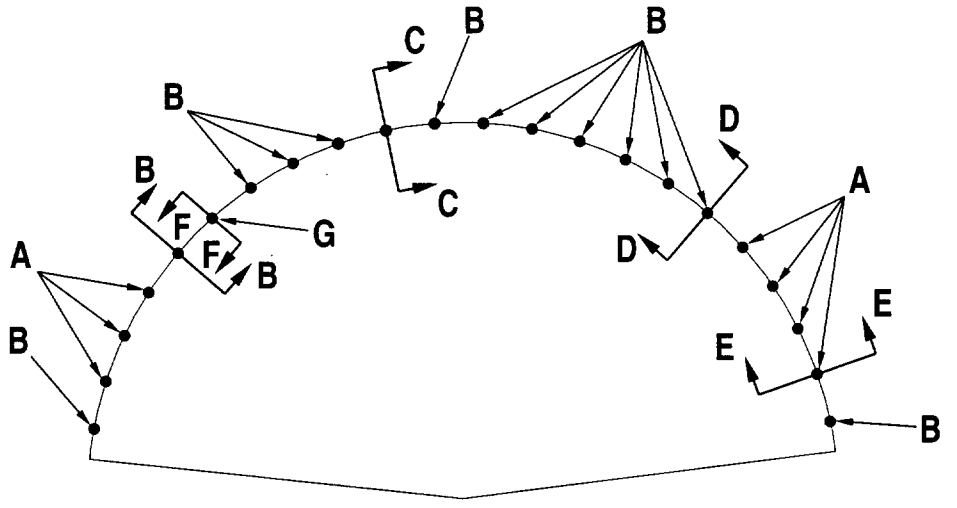
REPEAT SECTION D–D (REF. SHEET 3)

C19752B

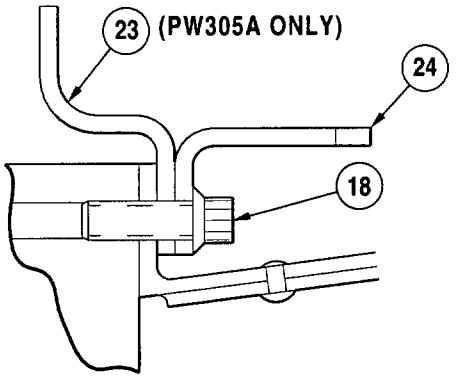
Upper Bypass Duct (Inner and Outer) - Removal/Installation
Figure 201 (Sheet 1 of 4)

Key to Figure 201

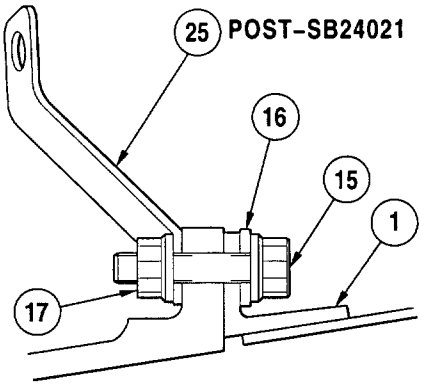
1. Outer Bypass Duct Half (Upper)
2. Screw (Pre-SB24441)
3. Inner Bypass Duct Segment (Upper Left)
4. Inner Bypass Duct Segment (Upper Right)
5. Screw (Pre-SB24441)
6. Washer
7. Fairing Support Bracket (Right Side)
8. Screw (Pre-SB24441)
9. Fairing (Upper Right)
10. Bypass Duct Half (Lower Ref.)
11. Fairing (Upper Left)
12. Fairing Support Bracket (Left Side)
13. Washer
14. Bolt
15. Bolt
16. Washer
17. Self-locking Nut
18. Bolt
19. Flange (Ref.)
20. Gas Generator Case Assembly (Ref.)
21. Fireseal (Part of Bypass Duct)
22. Intermediate Case (Ref.)
23. Bracket (Pre-SB24542 305A)
24. Bracket
25. Bracket (Post-SB24021 305B), (Pre-SB24542 305A)
26. Bracket (Pre-SB24016)
27. Bolt (Post-SB24441 and Post-SB24489)
28. Washer (Post-SB24441)



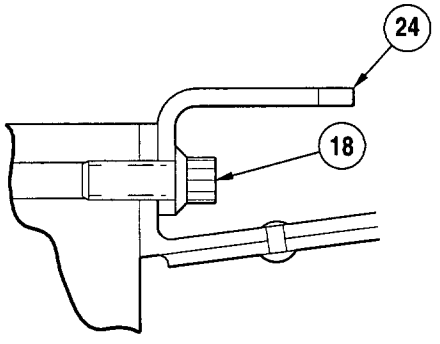
VIEW LOOKING FORWARD
ON FLANGE C



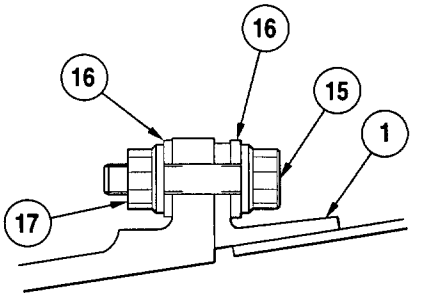
SECTION B-B
PRE-SB24542



SECTION C-C
PRE-SB24542



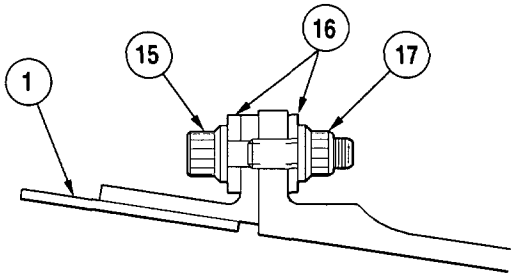
SECTION B-B
POST-SB24542



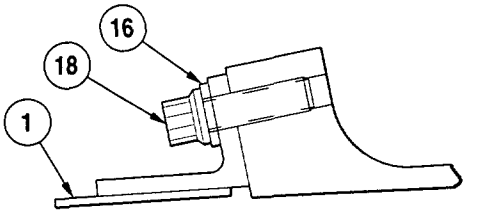
SECTION C-C
POST-SB24542

C30844B

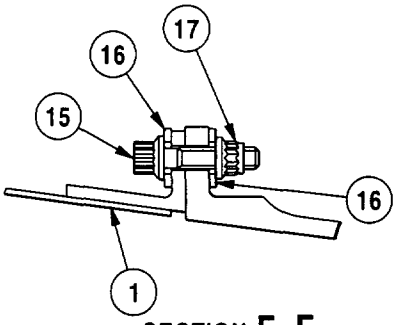
Upper Bypass Duct (Inner and Outer) - Removal/Installation
Figure 201 (Sheet 2)



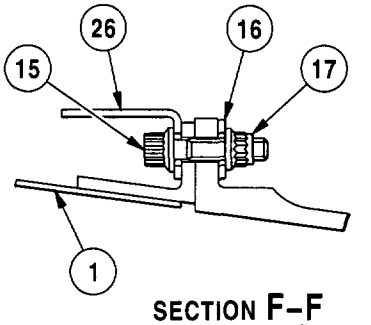
SECTION D-D
13 PLACES AT LOCATION B



SECTION E-E
7 PLACES AT LOCATION A



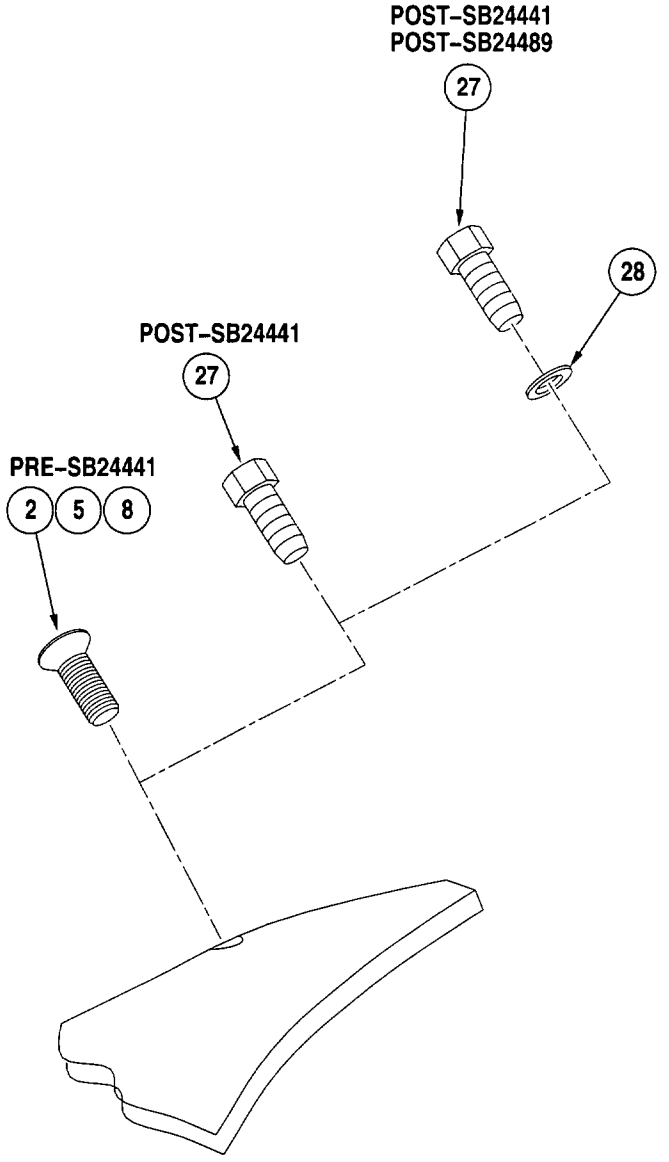
SECTION F-F
LOCATION G
PRE - SB24016



SECTION F-F
LOCATION G
POST - SB24016

C113433

Upper Bypass Duct (Inner and Outer) - Removal/Installation
Figure 201 (Sheet 3)



DETAIL **F**

C113915A

Upper Bypass Duct (Inner and Outer) - Removal/Installation
Figure 201 (Sheet 4)

(a) Remove 14 self-locking nuts (17), 21 bolts (15), bolt (18), bracket (24), 34 washers (16) and bracket (26).

(4) Remove 22 bolts (14) and 22 washers (13) from side flanges, and remove upper bypass duct (1).

B. Installation of Upper Section (Ref. Fig. 201)

(1) Apply a thin film of silicone compound (PWC09-003) on Flange C mating surface of upper bypass duct (1) (Ref. Section D-D, Area b).

(2) Position upper bypass duct (1) on lower bypass duct (10).

(3) Install 13 bolts (15), 13 nuts (17) and 26 washers (16) at positions marked "B" (Ref. Section D-D).

(4) Install bolt (15), nut (17) and two washers (16) (Pre-SB24021) or one washer (16) and bracket (25) (Post-SB24021) (Ref. Section C-C).

(5) Post-SB24542 (PW305A Engines Only):

(a) Install bolt (15), nut (17) and two washers (16).

(6) Install seven bolts (18) and seven washers (16) at positions marked "A" (Ref. Section E-E).

(7) Pre-SB24542 (PW305, PW305A and PW305B Engines):

(a) Install brackets (23 and 24) and bolt (18) (Ref. Section B-B).

(8) Post-SB24542 (PW305A Engines Only):

(a) Install bracket (24) and bolt (18) (Ref. Section B-B).

(9) Torque nuts (17) 27 to 30 lb.in. (3.0-3.4 Nm) (Ref. Section D-D).

(10) Torque bolts (18) 36 to 40 lb.in. (4.0-4.6 Nm) (Ref. Section B-B).

(11) Torque bolts (14) 36 to 40 lb.in. (4.0-4.6 Nm).

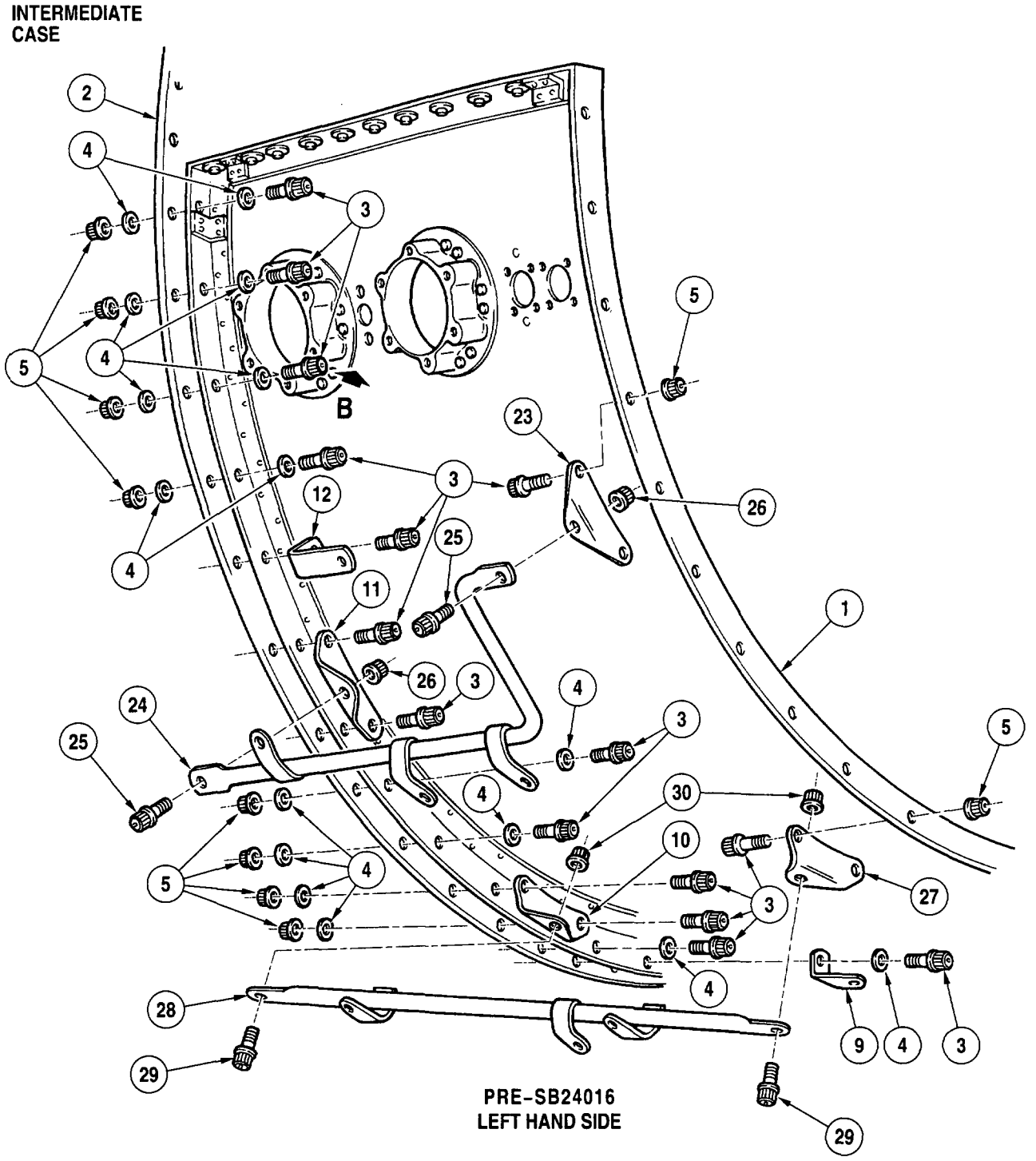
(12) Apply a thin film of organic compound (PWC05-020) to Area a on flange C (Ref. Section D-D).

NOTE: Overspray on adjacent surface not to exceed 0.300 inch (7.6 mm).

C. Removal of Lower Section (Ref. Fig. 202)

(1) Remove all silicone rubber sealant (gray type) from the lower fairings edges (Ref. Fig. 205).

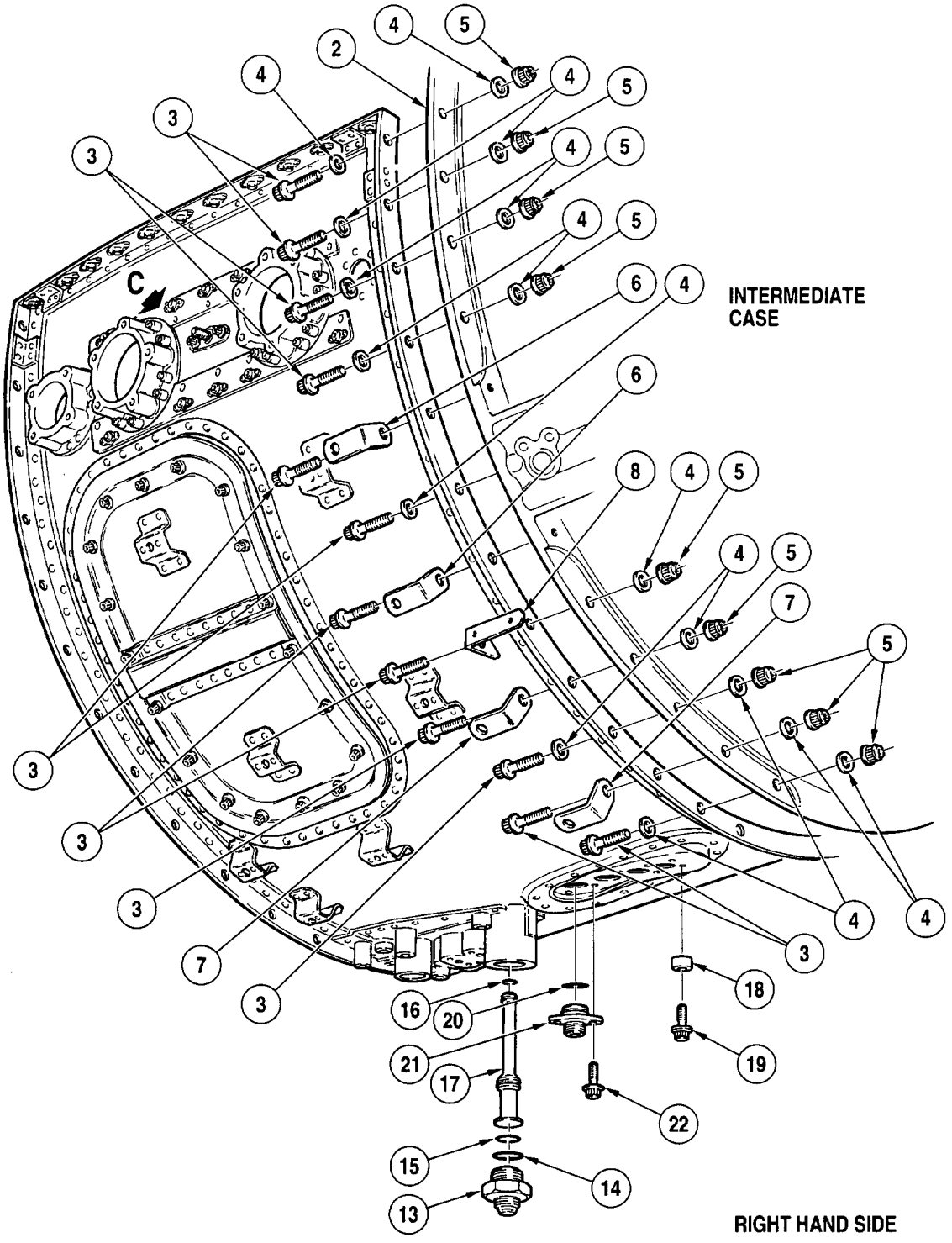
(2) Remove scavenge and pressure oil tubes for the No. 3 and No. 4 bearings (Ref. 79-20-03 and 79-20-04).



Removal/Installation of Outer Bypass Duct (Lower Section)
Figure 202 (Sheet 1 of 3)

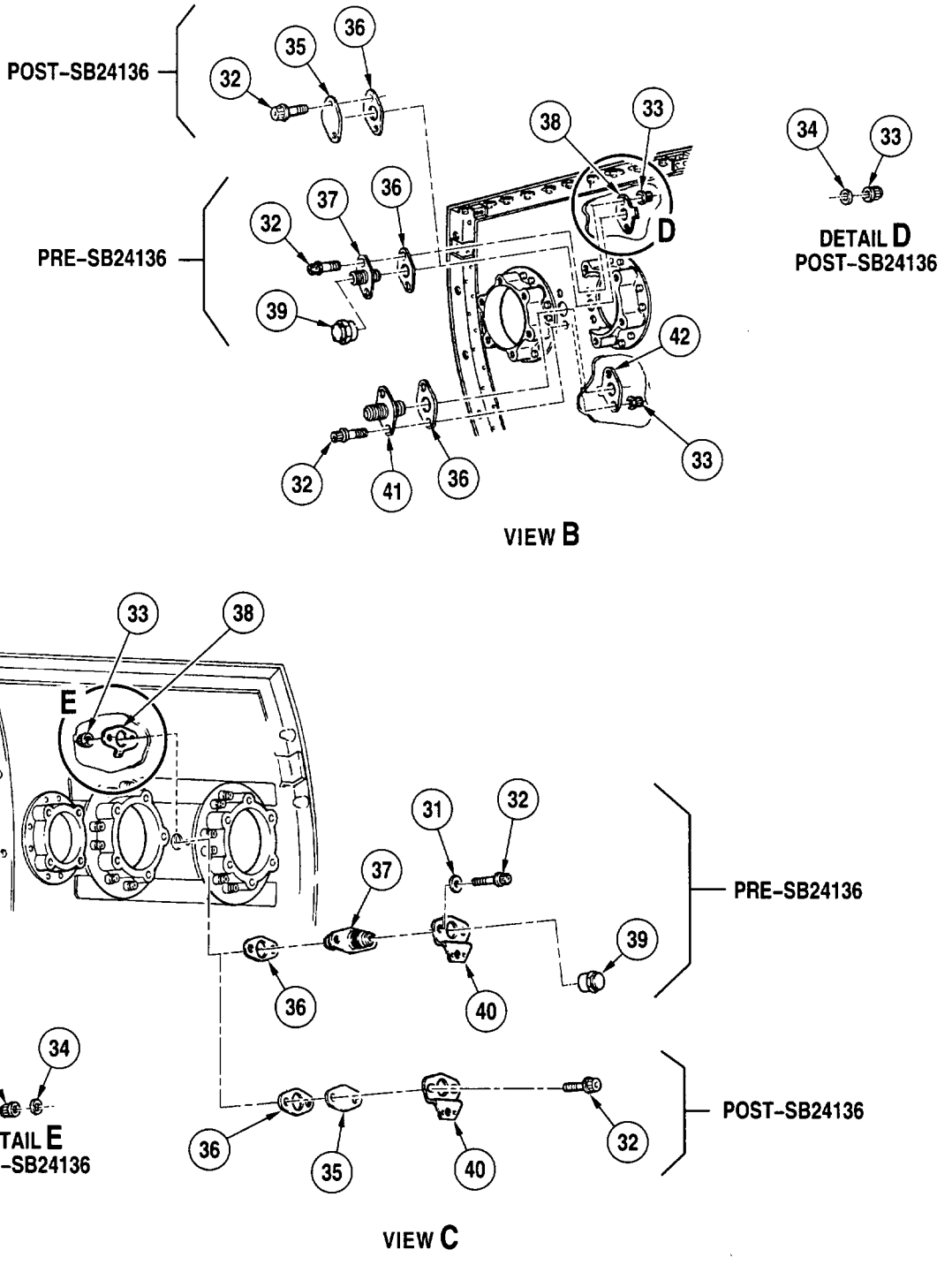
Key to Figure 202

1. Outer Bypass Duct (Lower Section)
2. Intermediate Case
3. Bolt
4. Washer
5. Self-locking Nut
6. Bracket
7. Bracket
8. Bracket
9. Bracket
10. Bracket
11. Bracket
12. Bracket
13. Fuel Drain Valve Adapter
14. Preformed Packing
15. Preformed Packing
16. Preformed Packing
17. Transfer Packing Tube
18. Spacer
19. Bolt
20. Preformed Packing
21. Adapter
22. Bolt
23. Bracket
24. Electrical Harness Support Tube Assembly
25. Bolt
26. Self-locking Nut
27. Bracket
28. Electrical Harness Support Tube Assembly
29. Bolt
30. Self-locking Nut
31. Washer (Pre-SB24136)
32. Bolt
33. Nut
34. Washer (Post-SB24136)
35. Blanking Plate (Post-SB24136)
36. Gasket
37. Flanged Coupling (Pre-SB24136)
38. Stiffener Plate (Pre-SB24136)
39. Cap (Pre-SB24136)
40. Bracket
41. Flanged Coupling
42. Stiffener Plate



C20140A

Removal/Installation of Outer Bypass Duct (Lower Section)
Figure 202 (Sheet 2)



C119088

Removal/Installation of Outer Bypass Duct (Lower Section)
Figure 202 (Sheet 3)

(3) Remove P2.5 cabin bleed air tubes and P3 air pressure tubes (Ref. 75-10-02).

(4) Remove fuel tubes (Ref. 73-10-01).

(5) Remove fuel waste ejector (Ref. 73-10-03).

(6) Remove fuel dump valve, fuel shutoff valve and fuel shutoff mechanism (Ref. 73-10-05).

(7) Remove HMU (Ref. 73-20-01).

(8) Remove two bolts (22), adapter (21) and preformed packing (20). Discard preformed packing.

(9) Remove two bolts (19) and spacers (18).

(10) Remove lockwire and remove fuel drain valve adapter (13). Remove transfer tube (17) using a bolt with a 0.250-28 thread. Remove and discard preformed packings (14, 15, 16).

NOTE: If it is necessary to disassemble the fuel drain valve adapter (13), refer to Chapter 73-10-05.

(11) On left side of duct, remove two nuts (26), bolts (25) and upper electrical harness support tube (24).

(12) Remove two nuts (30), bolts (29) and lower electrical harness support tube assembly (28).

(13) Remove 17 self-locking nuts (5), 30 washers (4), 25 bolts (3) and nine brackets (6 thru 12). Remove lower bypass duct (1) from intermediate case (2).

NOTE: Brackets (23, 27) may remain attached to rear flange of duct by bolts (3) and nuts (5).

D. Removal of Flanged Couplings and Blanking Plates on Outer Bypass Duct (Lower Section) (Ref. Fig. 202)

(1) If necessary, remove two bolts (32), two nuts (33), stiffener plate (42), flanged coupling (41) and gasket (36) (Ref. View B).

(2) Pre-SB24136:

(a) If necessary, remove cap (39), two bolts (32), two nuts (33), stiffener plate (38), flanged coupling (37) and gasket (36) (Ref. View B).

(b) If necessary, remove cap (39), two bolts (32), two washers (31), two nuts (33), stiffener plate (38), bracket (40), flanged coupling (37) and gasket (36) (Ref. View C).

(3) Post-SB24136:

(a) If necessary, remove two bolts (32), two nuts (33), two washers (34), blanking plate (35) and gasket (36) (Ref. View B).

(b) If necessary, remove two bolts (32), two nuts (33), two washers (34), bracket (40), blanking plate (35) and gasket (36) (Ref. View C).

E. Installation of Lower Section (Ref. Figs. 202 and 203)

(1) Coat mating surface of outer bypass duct (1, Fig. 202) Flange C with silicone compound (PWC09-003).

CAUTION: DO NOT LUBRICATE BOLTS AT LOCATION A.

(2) Align duct (1) with intermediate case (2) on three dowel pins and secure with 12 bolts (3), 24 washers (4) and 12 nuts (5) at Locations A. Torque nuts 27 to 30 lb.in. (3.0-3.4 Nm).

(3) Lubricate two bolts (3). Install bolts and two brackets (6) at Locations B. Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

CAUTION: DO NOT LUBRICATE BOLTS AT LOCATION C.

(4) Install two bolts (3), two brackets (7), two washers (4) and two nuts (5) at Locations C. Torque nuts 27 to 30 lb.in. (3.0-3.4 Nm).

(5) Lubricate one bolt (3). Install bolt and one washer (4) at Location D. Torque bolt 36 to 40 lb.in. (4.0-4.6 Nm).

CAUTION: DO NOT LUBRICATE BOLT AT LOCATION E.

(6) Install bracket (8), bolt (3), washer (4) and nut (5) at Location E with bracket facing forward. Torque nut 27 to 30 lb.in. (3.0-3.4 Nm).

(7) Lubricate bolt (3). Install bracket (9) and bolt (3) at Location F. Torque bolt 36 to 40 lb.in. (4.0-4.6 Nm).

CAUTION: DO NOT LUBRICATE BOLTS AT LOCATION G.

(8) Install bracket (10) at Location G and secure with two bolts (3), washers (4) and nuts (5). Torque nuts 27 to 30 lb.in. (3.0-3.4 Nm).

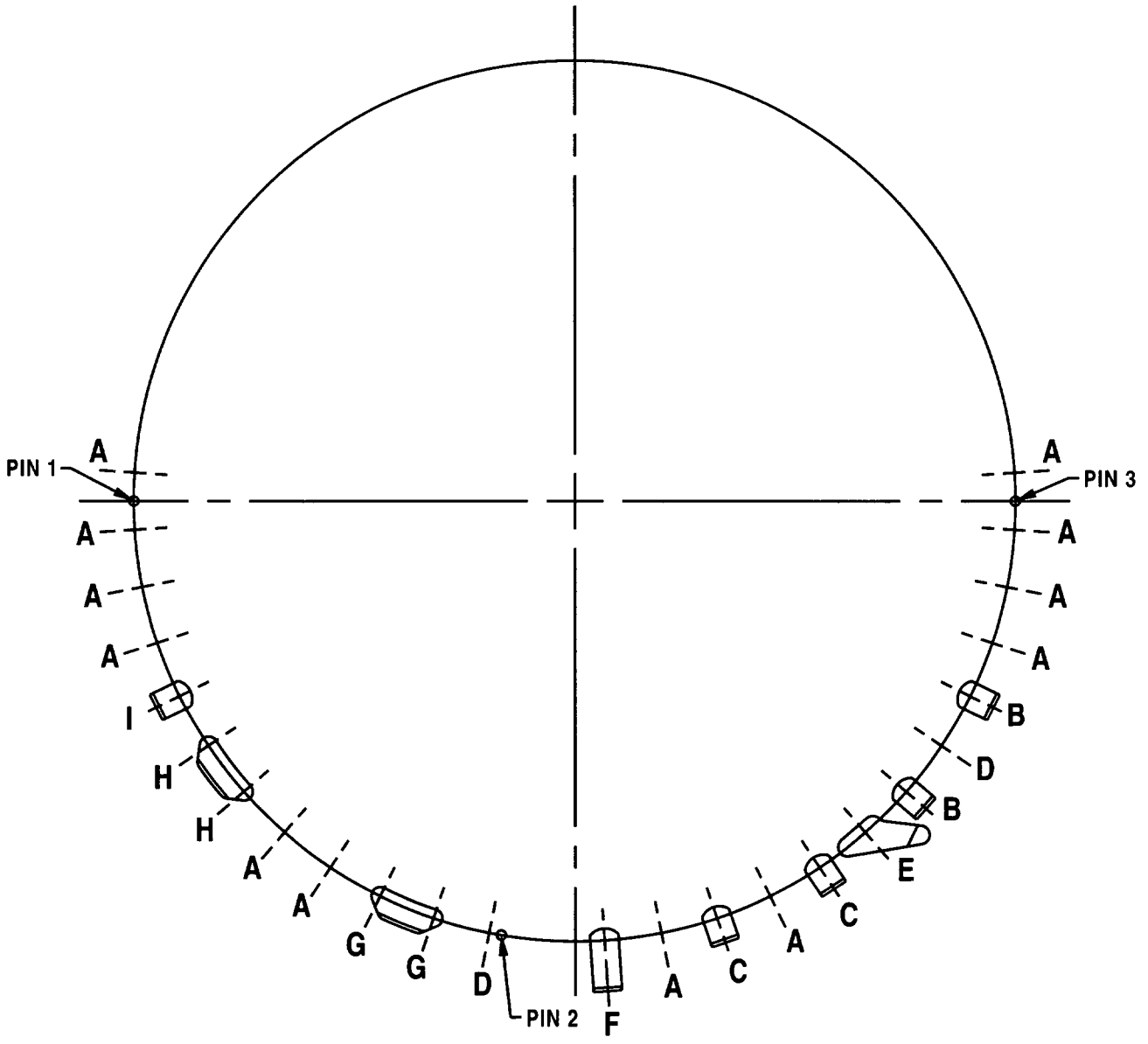
(9) Install bracket (11) at Location H. Lubricate two bolts (3) and secure bracket. Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(10) Install bracket (12) at Location I. Lubricate bolt (3) and secure bracket. Torque bolt 36 to 40 lb.in. (4.0-4.6 Nm).

CAUTION: DO NOT LUBRICATE THREADS OF FUEL DRAIN VALVE ADAPTER (13). INSTALL PREFORMED PACKING (14) DRY.

(11) Install new preformed packing (14) on fuel drain valve adapter (13).

(12) Lubricate new preformed packings (15, 16) and install on transfer tube (17). Install transfer tube (17) into outer bypass duct (1).



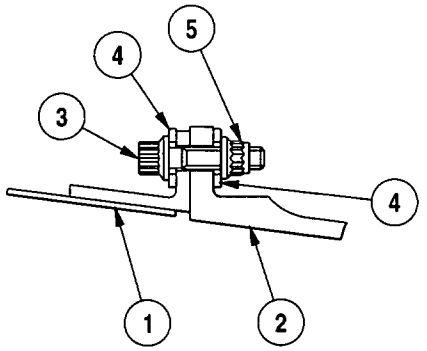
VIEW LOOKING FORWARD AT FLANGE C

C31355

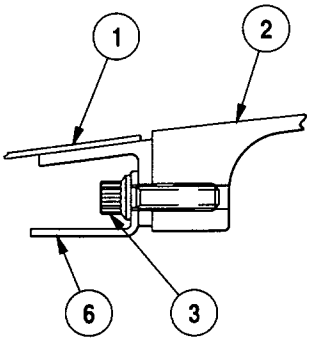
Outer Bypass Duct (Lower Section) Flange C - Location of Bolts and Brackets
Figure 203 (Sheet 1 of 2)

Key to Figure 203

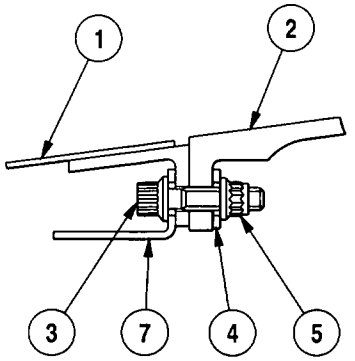
1. Outer Bypass Duct (Lower Section)
2. Intermediate Case
3. Bolt
4. Washer
5. Self-locking Nut
6. Bracket
7. Bracket
8. Bracket
9. Bracket
10. Bracket
11. Bracket
12. Bracket



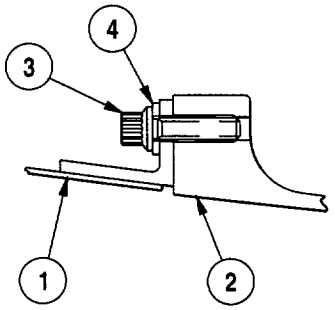
LOCATION A



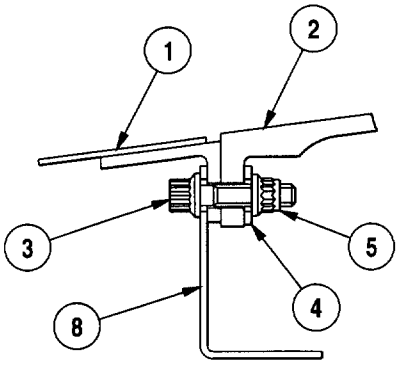
LOCATION B



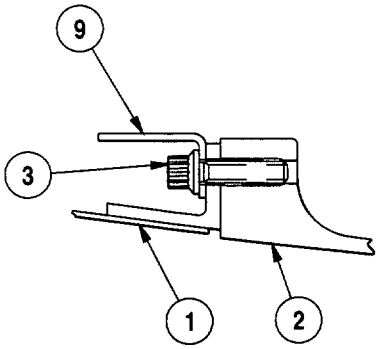
LOCATION C



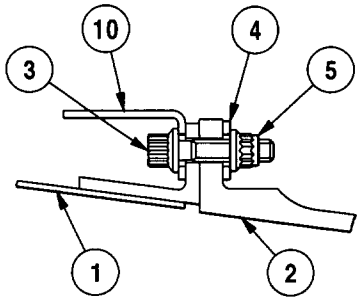
LOCATION D



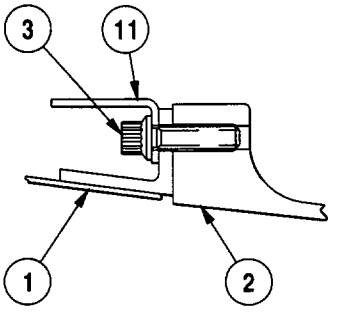
LOCATION E



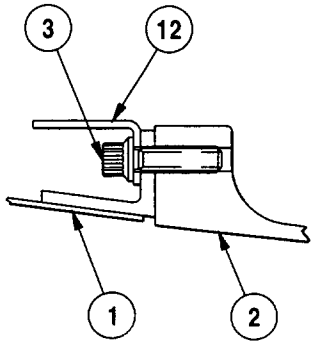
LOCATION F



LOCATION G



LOCATION H



LOCATION I

C31354

Outer Bypass Duct (Lower Section) Flange C - Location of Bolts and Brackets
Figure 203 (Sheet 2)

(13) Carefully coat packing (14) on fuel drain valve adapter (13) with calibrating fluid (PWC03-002) using a standard cotton swab. Carefully coat threads of adapter (13) with anti-seize compound (PWC06-023).

(14) Install drain valve adapter into outer bypass duct (1). Torque adapter 225 to 250 lb.in. (25.4-28.2 Nm) and lockwire (PWC05-089).

(15) Secure outer bypass duct (1) to fuel and oil pressure manifold with two spacers (18) and bolts (19). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(16) Lubricate new preformed packing (20) and install on adapter (21). Install adapter to outer bypass duct (1) and secure with two bolts (22). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(17) Position bracket (23) on rear flange of bypass duct (1) and secure with two bolts (3) and nuts (5). Tighten nuts with your fingers.

(18) Secure upper electrical harness support tube assembly (24) to brackets (11, 23) with two bolts (25) and nuts (26). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

(19) Position bracket (27) on rear flange of bypass duct (1) and secure with two bolts (3) and nuts (5). Tighten nuts with your fingers.

(20) Secure lower electrical harness support tube assembly (28) to brackets (10, 27) with two bolts (29) and nuts (30). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

F. Installation of Flanged Couplings and Blanking Plates on Outer Bypass Duct (Lower Section) (Ref. Figs. 202 and 203)

(1) If necessary, install gasket (36), flanged coupling (41), two bolts (32), stiffener plate (42) and two nuts (33) (Ref. View B).

(2) Pre-SB24136:

(a) If necessary, install gasket (36), flanged coupling (37), two bolts (32), stiffener plate (38), two nuts (33) and cap (39) (Ref. View B).

(b) If necessary, install gasket (36), flanged coupling (37), bracket (40), two washers (31), two bolts (32), stiffener plate (38), two nuts (33) and cap (39) (Ref. View C).

(3) Post-SB24136:

(a) If necessary, install gasket (36), blanking plate (35), two bolts (32), two washers (34) and two nuts (33) (Ref. View B).

(b) If necessary, install gasket (36), blanking plate (35), bracket (40), two bolts (32), two washers (34) and nut (33) (Ref. View C).

6. Inner Bypass Duct

A. Removal of Upper Section (Pre-SB24441) (Ref. Fig. 201)

(1) Remove 18 screws (8) and upper bypass duct fairings (9 and 11).

(2) Remove 13 screws (2) and bypass duct segments (3 and 4).

(3) Mark position of fairing supports (12 and 7) on left and right duct segments (3 and 4) with marker pen (PWC05-048) to facilitate reassembly. Remove three screws (5), three washers (6) and fairing support bracket (12 and 7).

NOTE: Fairing support brackets (12 and 7) may remain attached to inner bypass duct segments (3 and 4) unless removal is necessary.

B. Removal of Inner Bypass Duct (upper section) (Post-SB24441) (Ref. Fig. 201)

(1) Pre-SB24489:

(a) Remove 18 bolts (26) and upper bypass duct fairings (9 and 11).

(b) Remove 13 bolts (26) and bypass duct segments (3 and 4).

(2) Post-SB24489:

(a) Remove 18 bolts (26), 18 washers (27) and upper bypass duct fairings (9 and 11).

(b) Remove 13 bolts (26), 13 washers (27) and bypass duct segments (3 and 4).

(3) Mark position of fairing supports (12 and 7) on left and right duct segments (3 and 4) with marker pen (PWC05-018) to facilitate reassembly. Remove three bolts (26), three washers (6) and fairing support bracket (12 and 7).

NOTE: Fairing support brackets (12 and 7) may remain attached to inner bypass duct segments (3 and 4) unless removal is necessary.

C. Installation of Upper Section (Pre-SB24441) (Ref. Fig. 201)

(1) If required, install fairing support brackets (12 and 7) on inner left and right bypass duct segments (3 and 4) with six screws (5) and six washers. Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(2) Install upper left bypass duct segment (3). Ensure front edge is correctly inserted under flange (19) (Ref. Section C-C). Install with six screws (2). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(3) Install upper right bypass duct segment (4). Ensure front edge is correctly inserted under flange (19) (Ref. Section C-C). Install with seven screws (2). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(4) Loosely install fairing (9) and check that bracket (7) is properly aligned to provide support. Adjust bracket (7) as required to contact inside of fairing (9).

(5) Install upper right bypass duct fairing (9) with nine screws (8). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(6) Loosely install fairing (11) and check that bracket (12) is properly aligned to provide support. Adjust bracket (12) as required to contact inside of fairing (11).

(7) Install upper left bypass duct fairing (11) with nine screws (8). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

D. Installation of Inner Bypass Duct (Upper Section) (Post-SB24441) (Ref. Fig. 201)

(1) If required, Install fairing support brackets (12 and 7) on inner left and right bypass duct segments (3 and 4) with six bolts (26) and six washers (6). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(2) Install upper left bypass duct segment (3). Make sure front edge is correctly inserted under flange (19) (Ref. Section C-C). Install with six bolts (26). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(3) Install upper right bypass duct segment (4). Make sure front edge is correctly inserted under flange (19) (Ref. Section A-A). Install with seven bolts (26). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(4) Loosely install fairing (9) and check that bracket (7) is properly aligned to provide support. Adjust bracket (7) as required to contact inside of fairing (9).

(5) Install upper right bypass duct fairing (9) with nine bolts (26). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(6) Loosely install fairing (11) and check that bracket (12) is properly aligned to provide support. Adjust bracket (12) as required to contact inside of fairing (11).

(7) Install upper left bypass duct fairing (11) with nine bolts (8). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

E. Installation of Inner Bypass Duct (Upper Section) (Post-SB24441 and Post-SB24489) (Ref. Fig. 201)

(1) If required, Install fairing support brackets (12 and 7) on inner left and right bypass duct segments (3 and 4) with six bolts (26) and six washers (6). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(2) Install upper left bypass duct segment (3). Make sure front edge is correctly inserted under flange (19) (Ref. Section C-C). Install with six washers (27) and six bolts (26). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(3) Install upper right bypass duct segment (4). Make sure front edge is correctly inserted under flange (19) (Ref. Section A-A). Install with seven washers (27) and seven bolts (26). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(4) Loosely install fairing (9) and check that bracket (7) is properly aligned to provide support. Adjust bracket (7) as required to contact inside of fairing (9).

(5) Install upper right bypass duct fairing (9) with nine washers (27) and nine bolts (26). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(6) Loosely install fairing (11) and check that bracket (12) is properly aligned to provide support. Adjust bracket (12) as required to contact inside of fairing (11).

(7) Install upper left bypass duct fairing (11) with nine washers (27) and nine bolts (8). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

F. Removal of Lower Section (Pre-SB24441) (Ref. Fig. 204)

(1) Disconnect front core wiring harness from lower fairings (4 and 15) (Ref. 73-20-03).

(2) Remove five screws (3) and lower left side fairing (15).

(3) Pre-SB24564: Remove four self locking nuts (18), four washers (19), two bolts (20), two bolts (17) and fairing (11).

(4) Post-SB24564: Remove two bolts (20), two bolts (17) and fairing (11).

(5) Remove ten screws (3) and fairings (12 and 10).

(6) Remove five screws (3) and fairing assembly (4 and 5). Remove two screws (3) and separate fairing segments (4 and 5).

(7) Pre-SB24344:

(a) Remove six screws (3) and fuel nozzle inner cover (8).

(b) Remove five screws (3) and lower right bypass duct segment (9).

(8) Post-SB24344:

(a) Remove 16 screws (3) and BOV access cover (22) (Ref. sheet 2).

(b) Remove two screws (3) and lower right bottom bypass duct segment (21).

(c) Remove screw (3) and lower right top bypass duct segment (23).

(9) Post-SB24565:

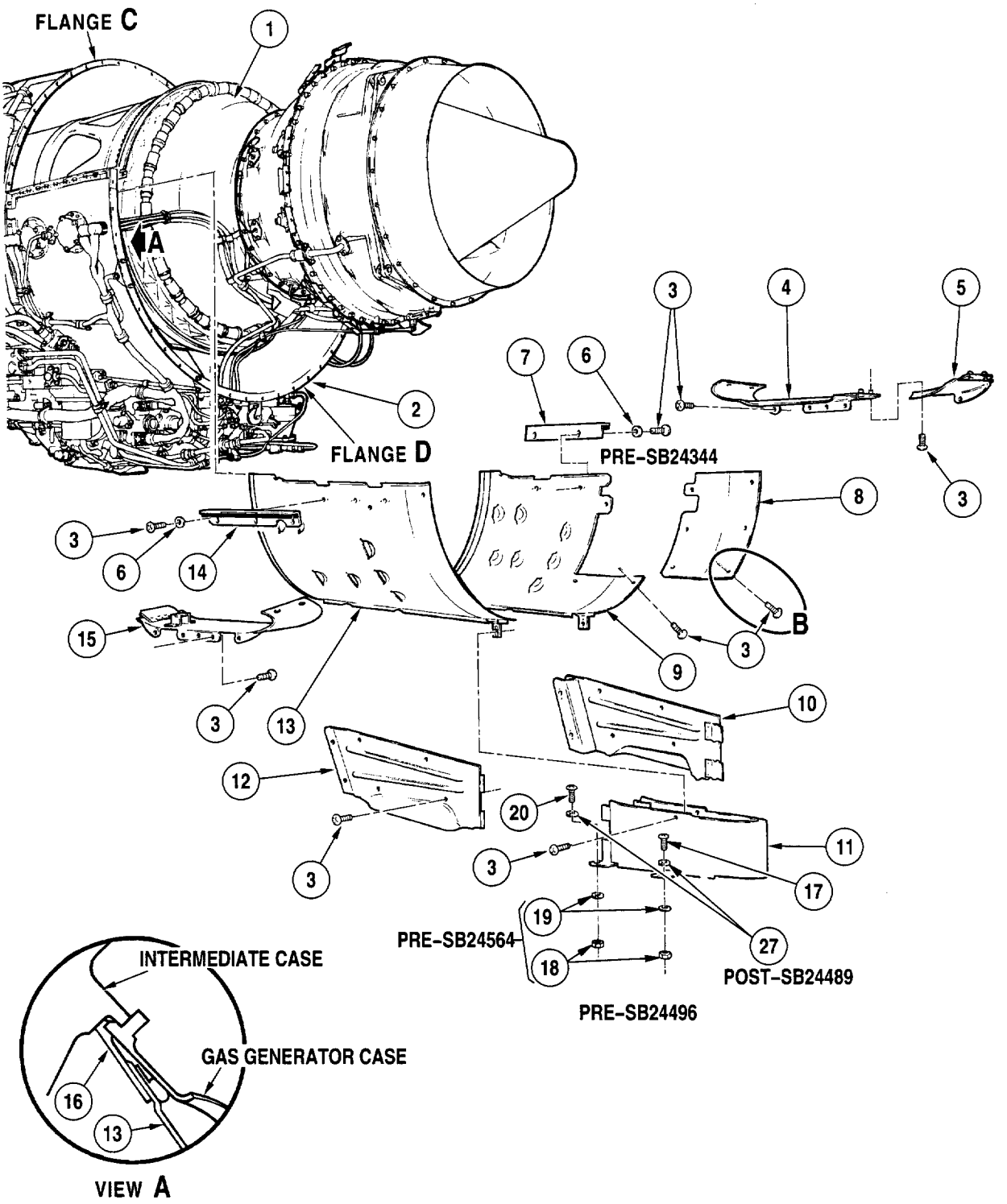
(a) Remove 17 screws (3) and BOV access cover (24) (Ref. sheet 2).

(b) Remove two screws (3) and lower right bottom bypass duct segment (21).

(c) Remove screw (3) and lower right top bypass duct segment (25).

(10) If required, Remove two screws (3), two washers (6) and fairing support bracket (7).

(11) Remove six screws (3) and lower left bypass duct segment (13).



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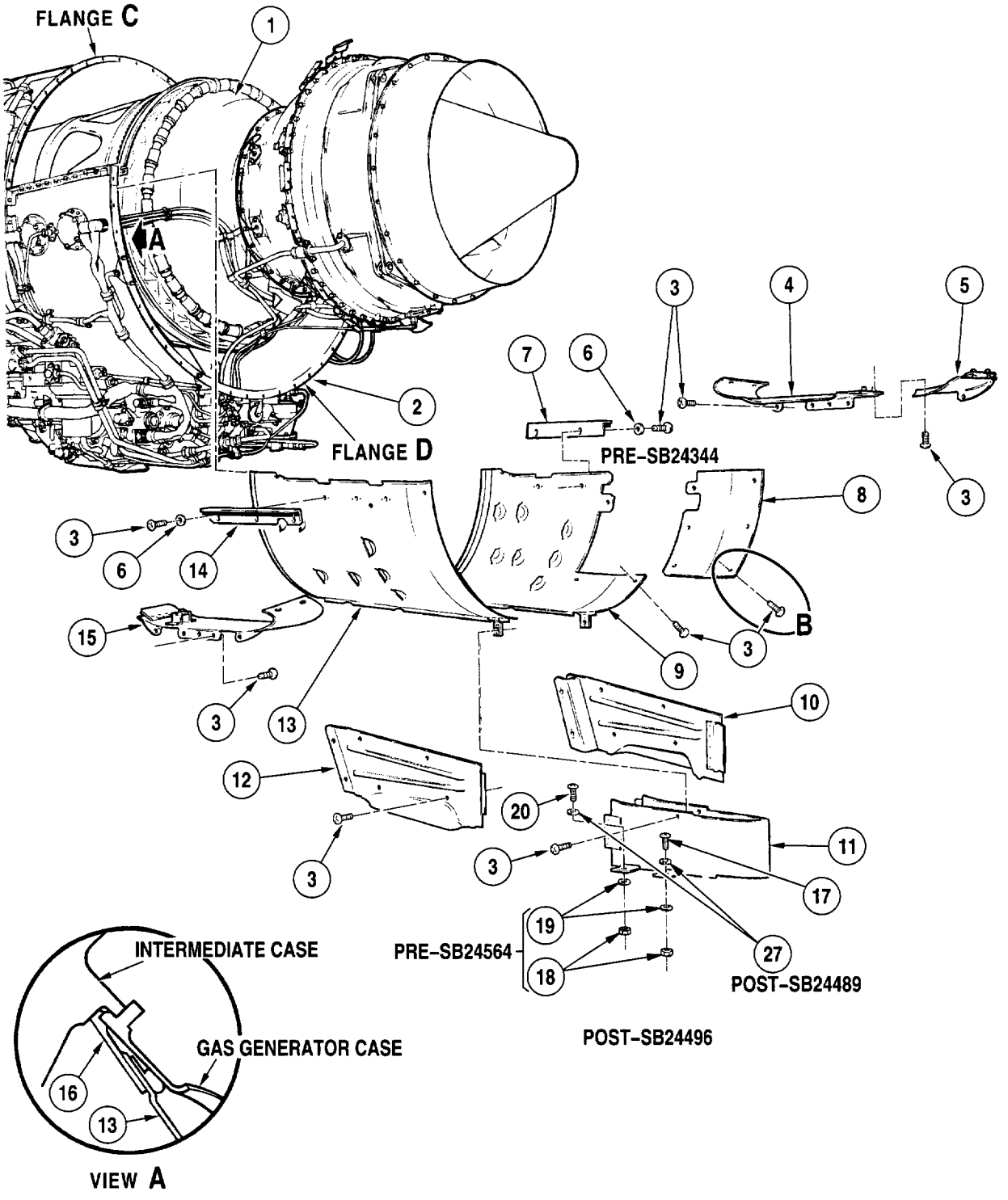
Inner Bypass Duct (Lower Section) - Removal/Installation
Figure 204 (Sheet 1 of 4)

Key to Figure 204

1. Combustion Chamber Outer Case (Ref.)
2. Lower Outer Bypass Duct Half Assembly (Ref.)
3. Screw (Pre-SB24441)
4. Lower Right Bypass Duct Fairing
5. Lower Right Bypass Duct Fairing
6. Washer
7. Fairing Support Bracket
8. Fuel Nozzle Inner Cover (Pre-SB24344)
9. Lower Right Bypass Duct Segment (Pre-SB24344)
10. Front Lower Right Bypass Fairing
11. Lower Rear Bypass Duct Fairing
12. Front Lower Left Bypass Fairing
13. Lower Left Bypass Duct Segment
14. Fairing Support Bracket
15. Lower Left Bypass Duct Fairing
16. Inner Bypass Duct Flange
17. Bolt
18. Self-locking Nut (Pre-SB24564)
19. Washer (Pre-SB24564)
20. Bolt
21. Lower Right Bottom Bypass Duct Segment (Post-SB24344)
22. BOV Access Cover (Post-SB24344 or Pre-SB24565)
23. Lower Right Top Bypass Segment (Post-SB24344 or Pre-SB24565)
24. BOV Access Cover (Post-SB24565)
25. Lower Right Top Bypass Segment (Post-SB24565)
26. Bolt (Post-SB24441)
27. Washer (Post-SB24489)



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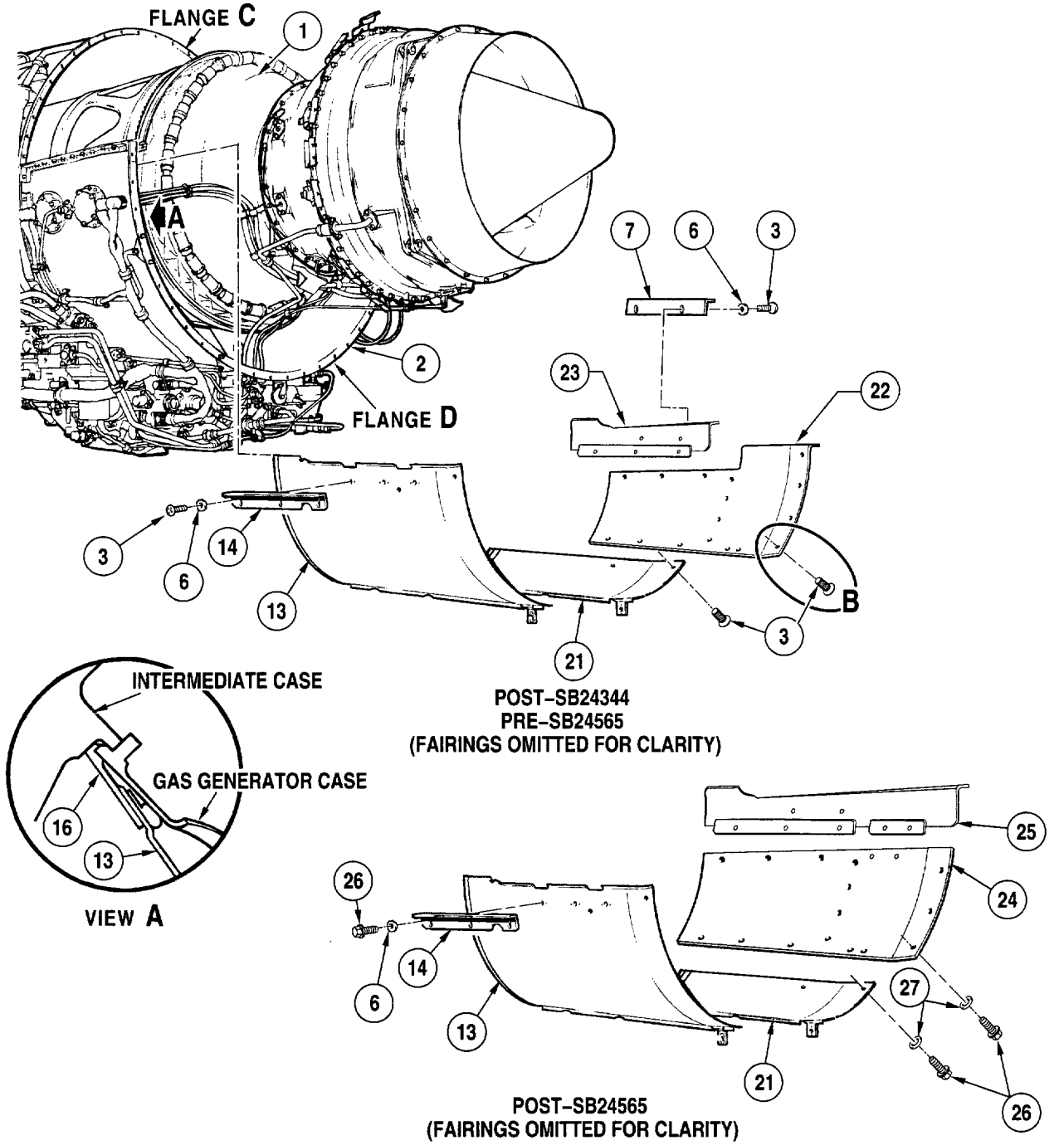
Inner Bypass Duct (Lower Section) - Removal/Installation
Figure 204 (Sheet 2)



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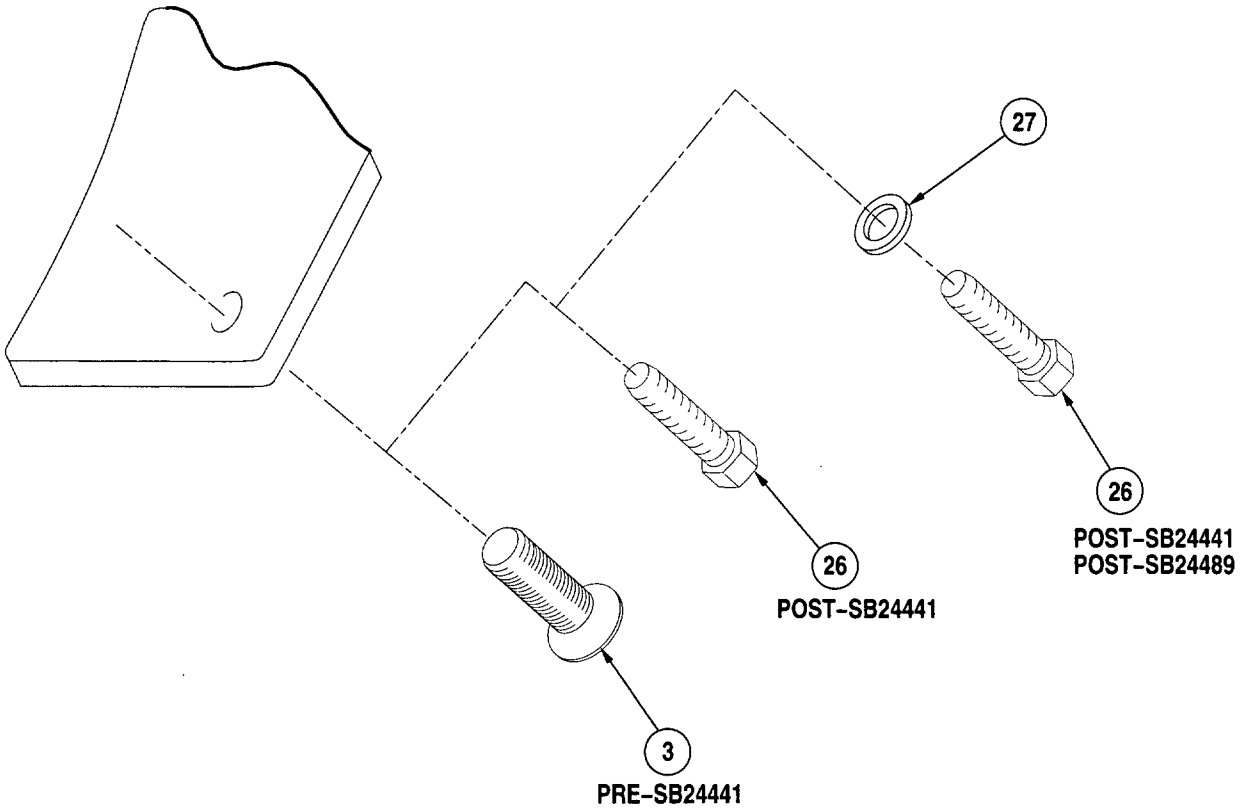
Inner Bypass Duct (Lower Section) - Removal/Installation
Figure 204 (Sheet 3)



DETAIL B

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Inner Bypass Duct (Lower Section) - Removal/Installation
Figure 204 (Sheet 4)

(12) If required, remove three screws (3), three washers (6) and fairing support bracket (14).

G. Removal of Lower Section (Post-SB24441) (Ref. Fig. 204)

(1) Disconnect front core wiring harness from lower fairings (4 and 15) (Ref. 73-20-03).

(2) Remove five bolts (26) and lower left side fairing (15).

(3) Pre-SB24564: Remove four self locking nuts (18), four washers (19), two bolts (20), two bolts (17) and fairing (11).

(4) Post-SB24564: Remove two bolts (20), two bolts (17) and fairing (11).

(5) Remove ten bolts (26) and fairings (12 and 10).

(6) Remove five bolts (26) and fairing assembly (4 and 5). Remove two bolts (26) and separate fairing segments (4 and 5).

(7) Pre-SB24344:

(a) Remove six bolts (26) and fuel nozzle inner cover (8).

(b) Remove five bolts (26) and lower right bypass duct segment (9).

(8) Post-SB24344:

(a) Remove 16 bolts (26) and BOV access cover (22).

(b) Remove two bolts (26) and lower right bottom bypass duct segment (21).

(c) Remove bolts (26) and lower right top bypass duct segment (23).

(9) Post-SB24565:

(a) Remove 17 bolts (26) and BOV access cover (24).

(b) Remove two bolts (26) and lower right bottom bypass duct segment (21).

(c) Remove bolts (26) and lower right top bypass duct segment (25).

(10) If required, remove two bolts (26), two washers (6) and fairing support bracket (7).

(11) Remove six bolts (26) and lower left bypass duct segment (13).

(12) If required, remove three bolts (26), three washers (6) and fairing support bracket (14).

H. Removal of Lower Section (Post-SB24441 and Post-SB24489) (Ref. Fig. 204)

(1) Disconnect front core wiring harness from lower fairings (4 and 15) (Ref. 73-20-03).

(2) Remove five bolts (26), five washers (27) and lower left side fairing (15).

(3) Pre-SB24564: Remove four self locking nuts (18), four washers (19), two bolts (20), two bolts (17), four washers (27) and fairing (11).

(4) Post-SB24564: Remove two bolts (20), two bolts (17), four washers (27) and fairing (11).

(5) Remove ten bolts (26), ten washers (27) and fairings (12 and 10).

(6) Remove five bolts (26), five washers (27) and fairing assembly (4 and 5). Remove two bolts (26), two washers (27) and separate fairing segments (4 and 5).

(7) Pre-SB24344:

(a) Remove six bolts (26), six washers (27) and fuel nozzle inner cover (8).

(b) Remove five bolts (26), five washers (27) and lower right bypass duct segment (9).

(8) Post-SB24344 and Pre-SB24565:

(a) Remove 16 bolts (26), 16 washers (27) and BOV access cover (22).

(b) Remove two bolts (26), two washers (27) and lower right bottom bypass duct segment (21).

(c) Remove bolts (26), washers (27) and lower right top bypass duct segment (23).

(9) Post-SB24565:

(a) Remove 17 bolts (26), 17 washers (27) and BOV access cover (24).

(b) Remove two bolts (26), two washers (27) and lower right bottom bypass duct segment (21).

(c) Remove bolts (26), washers (27) and lower right top duct segment (25).

(10) If required, remove two bolts (26), two washers (6) and fairing support bracket (7).

(11) Remove six bolts (26), six washers (27) and lower left bypass duct segment (13).

(12) If required, remove three bolts (26), three washers (6) and fairing support bracket (14).

I. Installation of Lower Section (Pre-SB24441) (Ref. Fig. 204)

(1) Pre-SB24344:

(a) If required, install fairing support brackets (14 and 7) on lower duct segments (13 and 9) in the same position as marked during removal. Install with five screws (3) and five washers (6). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(b) Install lower left bypass duct segment (13). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with six screws (3). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(c) Install lower right bypass duct segment (9). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with five screws (3). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(d) Install fuel nozzle inner cover (8) on duct segment (9) with six screws (3). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(2) Post-SB24344 and Pre-SB24565:

(a) If required, install fairing support brackets (14) on lower duct segments (13) in the same position as marked during removal. Install with three screws (3) and three washers (6). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(b) Install fairing support brackets (7) on lower duct segments (23) in the same position as marked during removal. Install with two screws (3) and two washers (6). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(c) Install lower left bypass duct segment (13). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with six screws (3). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(d) Install lower right top bypass duct segment (23). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with screw (3). Torque 36 to 40 lb. in. (4.0-4.6 Nm).

(e) Install lower right bottom bypass duct segments (21). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with two screws (3). Torque 36 to 40 lb. in (4.0-4.6 Nm).

(f) Install BOV access cover (22). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with 16 screws (3). Torque 36 to 40 lb. in. (4.0-4.6 Nm).

(3) Post-SB24344 and Post-SB24565:

(a) If required, install fairing support brackets (14) on lower duct segments (13) in the same position as marked during removal. Install with three screws (3) and three washers (6). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(b) Install fairing support brackets (7) on lower duct segments (25) in the same position as marked during removal. Install with two screws (3) and two washers (6). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(c) Install lower left bypass duct segment (13). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with six screws (3). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(d) Install lower right top bypass duct segment (25). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with screw (3). Torque 36 to 40 lb. in. (4.0-4.6 Nm).

(e) Install lower right bottom bypass duct segments (21). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with two screws (3). Torque 36 to 40 lb. in (4.0-4.6 Nm).

(f) Install BOV access cover (24). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with 17 screws (3). Torque 36 to 40 lb. in. (4.0-4.6 Nm).

(4) Assemble fairings (4 and 5) with two screws (3). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(5) Install fairing assembly (4, 5) on bypass duct half (2). Install with five screws (3). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

NOTE: If required adjust fairing support (7) until it contacts fairing assembly (4, 5).

(6) Install fairing assembly (15) on bypass duct half (2). Install with five screws (3). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

NOTE: If required adjust fairing support (15) until it contacts fairing (16).

(7) Install fairing assembly (10) with four screws (3). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(8) Install fairing (12) with six screws (3). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(9) Pre-SB24564: Position lower rear fairing (11) on bypass duct half (2). Install fairing with two bolts (17), two bolts (20), four washers (19) and four self-locking nuts (18). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(10) Post-SB24564: Position lower rear fairing (11) on bypass duct half (2). Install fairing with two bolts (17) and two bolts (20). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

J. Installation of Inner Bypass Duct (Lower Section) (Post-SB24441) (Ref. Fig. 204)

(1) Pre-SB24344:

(a) If required, Install fairing support brackets (14 and 7) on lower duct segments (13 and 9) in the same position as marked during removal. Install with five bolts (26) and five washers (6). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(b) Install lower left bypass duct segment (13). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with six bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(c) Install lower right bypass duct segment (9). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with five bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(d) Install fuel nozzle inner cover (8) on duct segment (9) with six bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(2) Post-SB24344 and Pre-SB24565:

(a) If required, Install fairing support bracket (14) on lower duct segments (13) in the same position as marked during removal. Install with three bolts (26) and three washers (6). Torque 36 to 40 lb. in. (4.0 to 4.6 Nm).

(b) Install fairing support bracket (7) on the lower right top bypass duct segment (23) in the same position as marked during removal. Install with two bolts (26) and two washers (6). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(c) Install lower left bypass duct segment (13). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with six bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(d) Install lower right top bypass duct segments (23). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with bolts (26). Torque 36 to 40 lb. in. (4.0 to 4.6 Nm).

(e) Install lower bypass duct segments (21). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with two bolts (26). Torque 36 to 40 lb. in (4.0-4.6 Nm).

(f) Install BOV access cover (22). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with 16 bolts (26). Torque 36 to 40 lb. in. (4.0-4.6 Nm)

(3) Post-SB24344 and Post-SB24565:

(a) If required, Install fairing support bracket (14) on lower duct segment (13) in the same position as marked during removal. Install with three bolts (26) and three washers (6). Torque 36 to 40 lb. in. (4.0 to 4.6 Nm).

(b) Install fairing support bracket (7) on the lower right top bypass duct segment (25) in the same position as marked during removal. Install with two bolts (26) and two washers (6). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(c) Install lower left bypass duct segment (13). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with six bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(d) Install lower right top bypass duct segments (25). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with bolts (26). Torque 36 to 40 lb. in. (4.0 to 4.6 Nm).

(e) Install lower bypass duct segments (21). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with two bolts (26). Torque 36 to 40 lb. in (4.0-4.6 Nm).

(f) Install BOV access cover (24). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with 17 bolts (26). Torque 36 to 40 lb. in. (4.0-4.6 Nm).

(4) Assemble fairings (4 and 5) with two bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(5) Install fairing assembly (4 and 5) on bypass duct half (2). Install with five bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

NOTE: If required adjust fairing support (7) until it contacts fairing assembly (4 and 5).

(6) Install fairing assembly (15) on bypass duct half (2). Install with five bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

NOTE: If required adjust fairing support (15) until it contacts fairing (16).

(7) Install fairing assembly (10) with four bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(8) Install fairing (12) with six bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(9) Pre-SB24564: Position lower rear fairing (11) on bypass duct half (2). Install fairing with two bolts (17), two bolts (20), four washers (19) and four self-locking nuts (18). Torque 27 to 30 lb.in. (3.0 to 3.4 Nm).

(10) Post-SB24564: Position lower rear fairing (11) on bypass duct half (2). Install fairing with two bolts (17) and two bolts (20). Torque 27 to 30 lb.in. (3.0 to 3.4 Nm).

K. Installation of Inner Bypass Duct (Lower Section) (Post-SB24441 and Post-SB24489) (Ref. Fig. 204)

(1) Pre-SB24344:

(a) If required, Install fairing support brackets (14 and 7) on lower duct segments (13 and 9) in the same position as marked during removal. Install with five bolts (26) and five washers (6). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(b) Install lower left bypass duct segment (13). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with six washers (27) and six bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(c) Install lower right bypass duct segment (9). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with five washers (27), five bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(d) Install fuel nozzle inner cover (8) on duct segment (9) with six washers (27) six bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(2) Post-SB24344 and Pre-SB24565:

(a) If required, Install fairing support bracket (14) on lower duct segments (13) in the same position as marked during removal. Install with three bolts (26) and three washers (6). Torque 36 to 40 lb. in. (4.0 to 4.6 Nm).

(b) Install fairing support bracket (7) on the lower right top bypass duct segment (23) in the same position as marked during removal. Install with two bolts (26) and two washers (6). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(c) Install lower left bypass duct segment (13). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with six washers (27) and six bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(d) Install lower right top bypass duct segments (23). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with washers (27) and bolts (26). Torque 36 to 40 lb. in. (4.0 to 4.6 Nm).

(e) Install lower bypass duct segments (21). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with two washers (27) and two bolts (26). Torque 36 to 40 lb. in (4.0-4.6 Nm).

(f) Install BOV access cover (22). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with 16 washers (27) and 16 bolts (26). Torque 36 to 40 lb. in. (4.0-4.6 Nm).

(3) Post-SB24344 and Post-SB24565:

(a) If required, Install fairing support bracket (14) on lower duct segments (13) in the same position as marked during removal. Install with three bolts (26) and three washers (6). Torque 36 to 40 lb. in. (4.0 to 4.6 Nm).

(b) Install fairing support bracket (7) on the lower right top bypass duct segment (25) in the same position as marked during removal. Install with two bolts (26) and two washers (6). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(c) Install lower left bypass duct segment (13). Make sure front edge is correctly inserted under flange (16) (Ref. View A). Install duct with six washers (27) and six bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(d) Install lower right top bypass duct segments (25). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with washers (27) and bolts (26). Torque 36 to 40 lb. in. (4.0 to 4.6 Nm).

(e) Install lower bypass duct segments (21). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with two washers (27) and two bolts (26). Torque 36 to 40 lb. in (4.0-4.6 Nm).

(f) Install BOV access cover (24). Make sure front edge is correctly inserted under flange (16) (Ref. view A). Install with 17 washers (27) and 17 bolts (26). Torque 36 to 40 lb. in. (4.0-4.6 Nm).

(4) Assemble fairings (4, 5) with two washers (27) two bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(5) Install fairing assembly (4, 5) on bypass duct half (2). Install with five washers (27) and five bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

NOTE: If required adjust fairing support (7) until it contacts fairing assembly (4 and 5).

(6) Install fairing assembly (15) on bypass duct half (2). Install with five washers (27) and five bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

NOTE: If required adjust fairing support (15) until it contacts fairing (16).

(7) Install fairing assembly (10) with four washers (27) and four bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(8) Install fairing (12) with six washers and six bolts (26). Torque 36 to 40 lb.in. (4.0 to 4.6 Nm).

(9) Pre-SB24564: Position lower rear fairing (11) on bypass duct half (2). Install fairing with four washers (27), two bolts (17), two bolts (20), four washers (19) and four self-locking nuts (18). Torque 27 to 30 lb.in. (3.0 to 3.4 Nm).

(10) Post-SB24564: Position lower rear fairing (11) on bypass duct half (2). Install fairing with four washers (27), two bolts (17) and two bolts (20). Torque 27 to 30 lb.in. (3.0 to 3.4 Nm).

7. Inner Bypass Duct Fairings

A. Application of Sealant (Ref. Fig. 205)

(1) Remove any remaining original sealant from the fairing assembly (3) with a suitable non-metallic scraper.

(2) Clean area a adjacent to the gap with solvent (PWC11-002).

(3) Apply sealant (PWC09-019) at area a to fill the gap all around the fairing assembly (3).

(4) If necessary, moisten with water and gently smooth out the sealant.

8. Inspection/Check

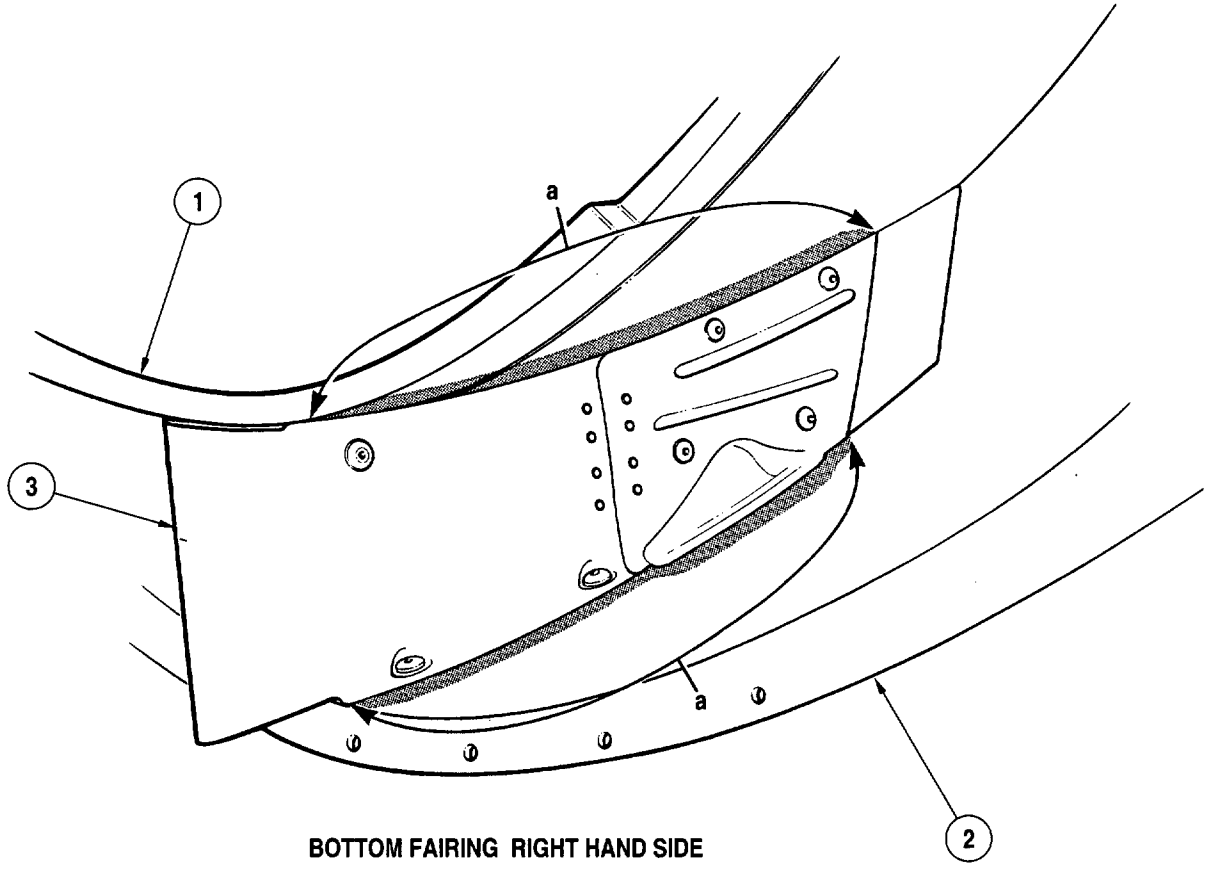
A. Visual Check

(1) Inspect outer by-pass duct (upper and lower) for:

(a) Cracks. No cracks permitted.

(b) Nicks or dents. Acceptable, with blending to a maximum depth of 0.010 inch (0.25 mm).

(c) Loose or damaged rivets. Replace as necessary.



BOTTOM FAIRING RIGHT HAND SIDE
LEFT HAND SIDE SIMILAR

C64761

Inner Bypass Duct Fairing - Application of Sealant
Figure 205

Key to Figure 205

1. Inner Lower Bypass Duct
2. Outer Lower Bypass Duct
3. Lower Bypass Fairing

(d) Anchor nut security and rundown torque. Replace if loose or rundown torque not within limits specified (Ref. 70-00-00, STANDARD PRACTICES).

(2) Inspect inner by-pass duct fairings for:

(a) Cracks up to a maximum length of 1.500 inches may be stop drilled more than once.

(b) Converging cracks or cracks with the potential for material loss are not acceptable.

(c) Cracks starting at a free edge are acceptable up to a maximum length of 1.500 inches if they are stop drilled with a 0.125 inch dia. drill.

(d) Cracks starting in a nut plate are acceptable up to a maximum length of 1.500 inches if they are stop drilled with a 0.125 inch dia. drill.

(e) Cracks starting at a bolt hole location are acceptable up to a maximum length of 1.500 inches if they are stop drilled with a 0.125 inch dia. drill.

(f) Nicks or dents. Acceptable, with blending to a maximum depth of 0.005 inch (0.13 mm).

(g) Loose or damaged rivets or fasteners. Replace as necessary.

(3) Inspect BOV cover and remaining inner by-pass ducts for:

(a) Cracks up to a maximum length of 2.000 inches may be stop drilled more than once.

(b) Converging cracks or cracks with the potential for material loss are not acceptable.

(c) Cracks starting at a free edge are acceptable up to a maximum length of 2.000 inches if they are stop drilled with a 0.125 inch dia. drill.

(d) Cracks starting in a nut plate are acceptable up to a maximum length of 2.000 inches if they are stop drilled with a 0.125 inch dia. drill.

(e) Cracks starting from the air scoops are acceptable up to a maximum length of 2.000 inches if they are stop drilled with a 0.125 inch dia. drill.

(f) Cracks starting at a bolt hole location are acceptable up to a maximum length of 2.000 inches if they are stop drilled with a 0.125 inch dia. drill.

(g) Nicks or dents are acceptable, with blending to a maximum depth of 0.005 inch (0.13 mm).

(h) Replace loose or damaged rivets or fasteners as necessary.

(4) Nut plates:

(a) Damaged anchor nuts are acceptable provided one of the nuts is secure and meets rundown torque requirements (Ref. 70-00-00, STANDARD PRACTICES).

CHAPTER

73

ENGINE FUEL AND CONTROL

TABLE OF CONTENTS

SUBJECT	PAGE
FUEL AND CONTROL - DESCRIPTION AND OPERATION	**73-00-00**
1. Engine Control System - General	1
2. Engine Fuel System - General	1
3. Electronic Engine Control (EEC)	1
A. Calculation of Required N1	13
B. N1 and N2 Electronic Overspeed Protection	13
C. Engine Shutdown	14
D. Power Supplies to EEC	14
4. Hydromechanical Fuel Control Unit (HFCU or HMU)	15
A. Regulation of Burn Flow	15
B. Positioning of HP Compressor Geometry	15
C. Engine Shutdown	16
D. Underpressure and Overpressure Protection	16
5. Fuel Pump	16
6. Fuel Manifold	16
7. Fuel Dump Valve (Pre-SB24156)	19
8. Start and Fuel Dump Valve (PW305A or Post-SB24156)	19
9. Fuel Waste Ejector	19
10. Motive Flow Valve (PW305A)	21
11. Emergency Fuel Shut-off	21
A. Emergency Fuel Shut-off Actuating Mechanism	21
B. Fuel Shutoff Valve	21
12. Wiring Harnesses	24
A. Rear Core Harness	24
B. Front Core Harness	24
C. Outer Wiring Harness	24

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Jul 11/2003
	2 blank	Jul 11/2003
Contents	1	Jul 11/2003
	2 blank	Jul 11/2003
73-00-00 Description and Operation	1	Nov 19/99
	2	Nov 19/99
	3	Nov 19/99
	4	Nov 19/99
	5	Nov 19/99
	6	Nov 19/99
	7	Nov 19/99
	8	Nov 19/99
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	33	Nov 19/99
	34	Dec 07/2001
	35	Nov 19/99
	36	Nov 19/99
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	38	Dec 07/2001
	39	Nov 19/99
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FUEL AND CONTROL - DESCRIPTION AND OPERATION

1. Engine Control System - General (Ref. Fig. 1)

PW305 engine thrust is controlled by a dual channel full authority digital electronic control (FADEC) which regulates low rotor (fan) speed N1 in response to a pilot-operated Thrust Lever (TL). Main control system components are the Thrust Lever (TL), Electronic Engine Control (EEC) and the Hydromechanical Fuel Control Unit (HFCU or HMU).

The Thrust Lever (TL) is the pilot-demanded set point for the control system. Thrust Lever Angle (TLA) is converted to an electrical signal by a Rotary Variable Differential Transformer (RVDT) position transducer and sent to the EEC as its set point.

The EEC is the electronic "brain" of the control system. The EEC performs thrust management, compressor surge control, high and low pressure compressor rotor overspeed protection (N2 and N1 O/S PROT).

Provision is made for installation of an airframe-supplied fuel flowmeter located between the HMU and the dump valve.

2. Engine Fuel System - General (Ref. Figs. 2 and 3)

The basic fuel system is comprised of the following units:

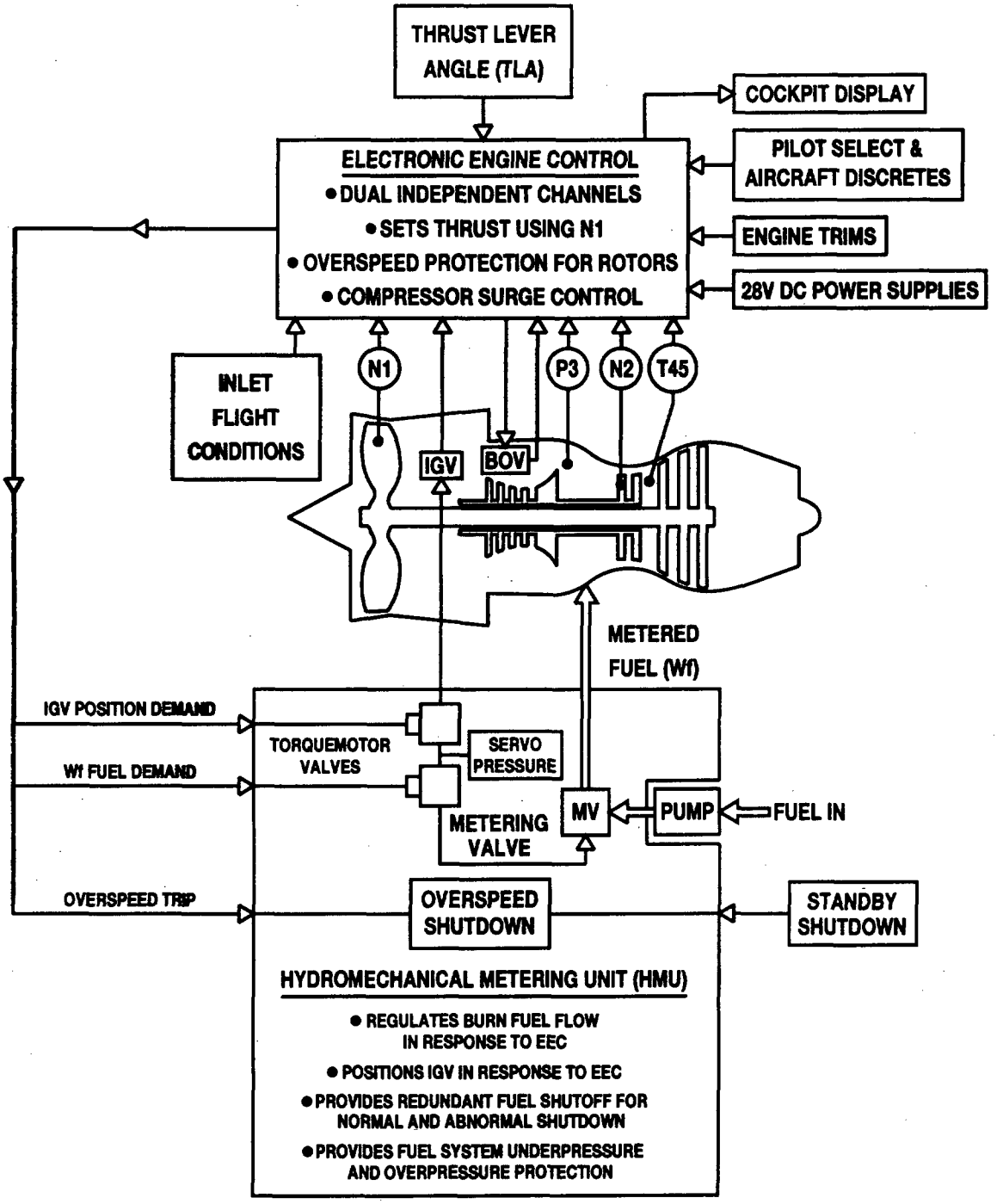
- Hydromechanical fuel control unit (HFCU or HMU).
- Engine-driven, two-stage cartridge-style fuel pump mounted in the HMU.
- Fuel filter.
- Fuel/oil heat exchanger.
- Dump valve.
- Fuel waste ejector.
- Fuel shutoff valve.
- Fuel manifold containing 22 main fuel nozzles and 2 hybrid nozzles.

3. Electronic Engine Control (EEC) (Ref. Figs. 4 thru 8)

Determination of correct N1 value is accomplished within the EEC. This module features two independent channels - either of which can fully control the engine. Should one channel become impaired e.g.: sensor fault, control is automatically transferred to the healthier channel. If both channels are impaired, engine control is achieved at reduced capacity.

Thrust lever angle (TLA) is sensed by the EEC and fuel flow (Wf) to the engine is regulated by electrical commands to the HFCU such that actual N1 value matches calculate required value.

Figure 5 illustrates in block form how engine and airframe interface with one of two identical channels.



FULL AUTHORITY DIGITAL ELECTRONIC CONTROL (FADEC)

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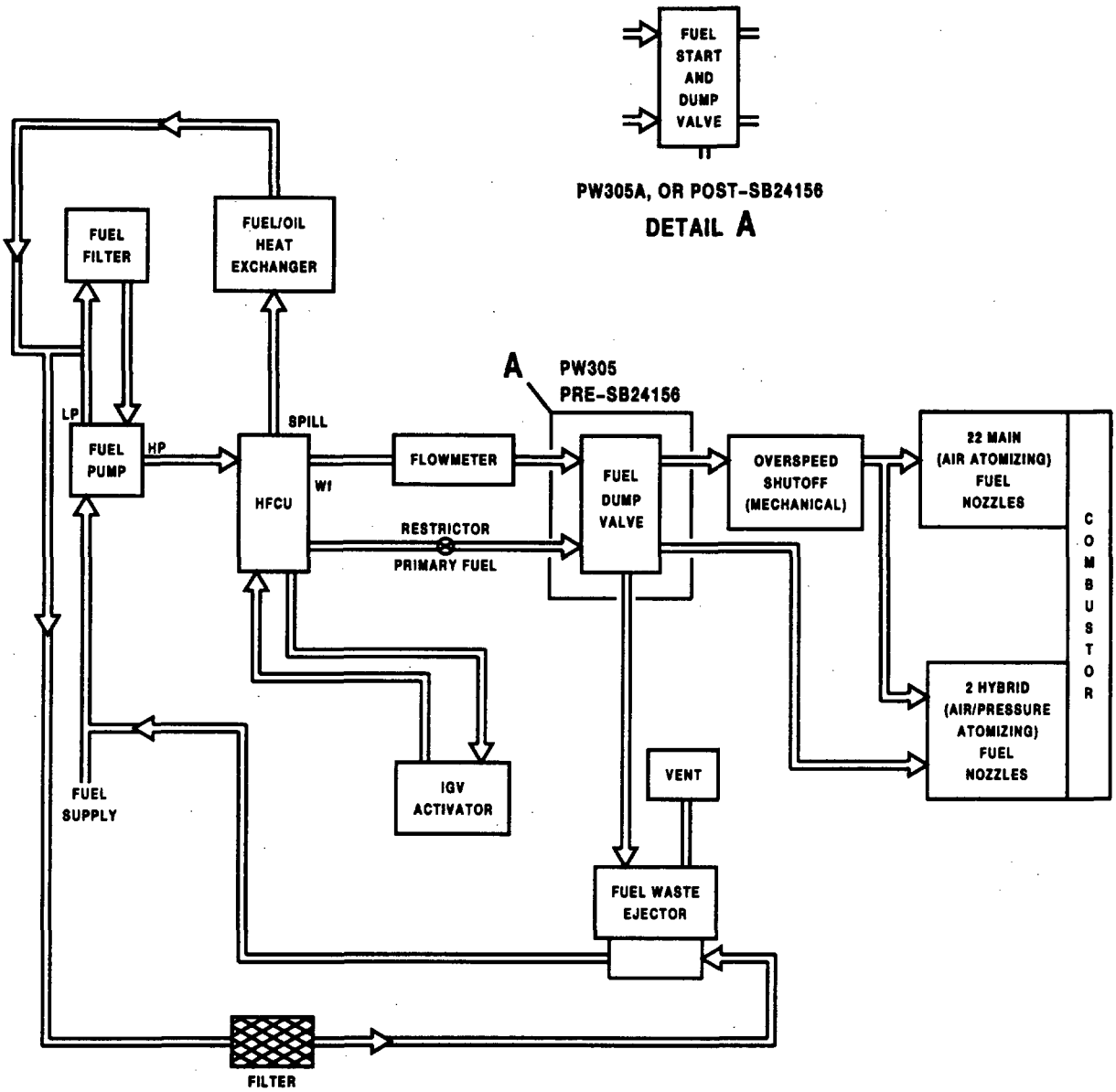
Engine Control System
Figure 1



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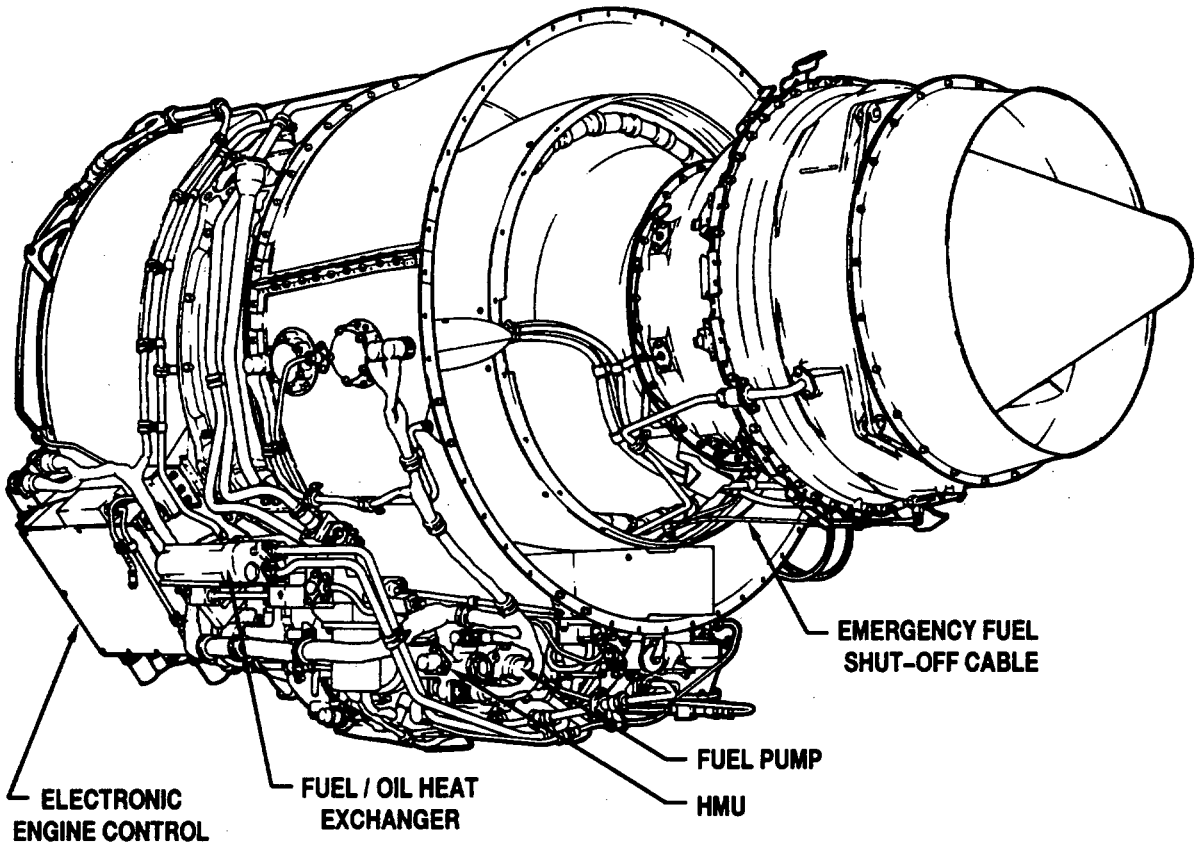
Fuel System Block Diagram
Figure 2



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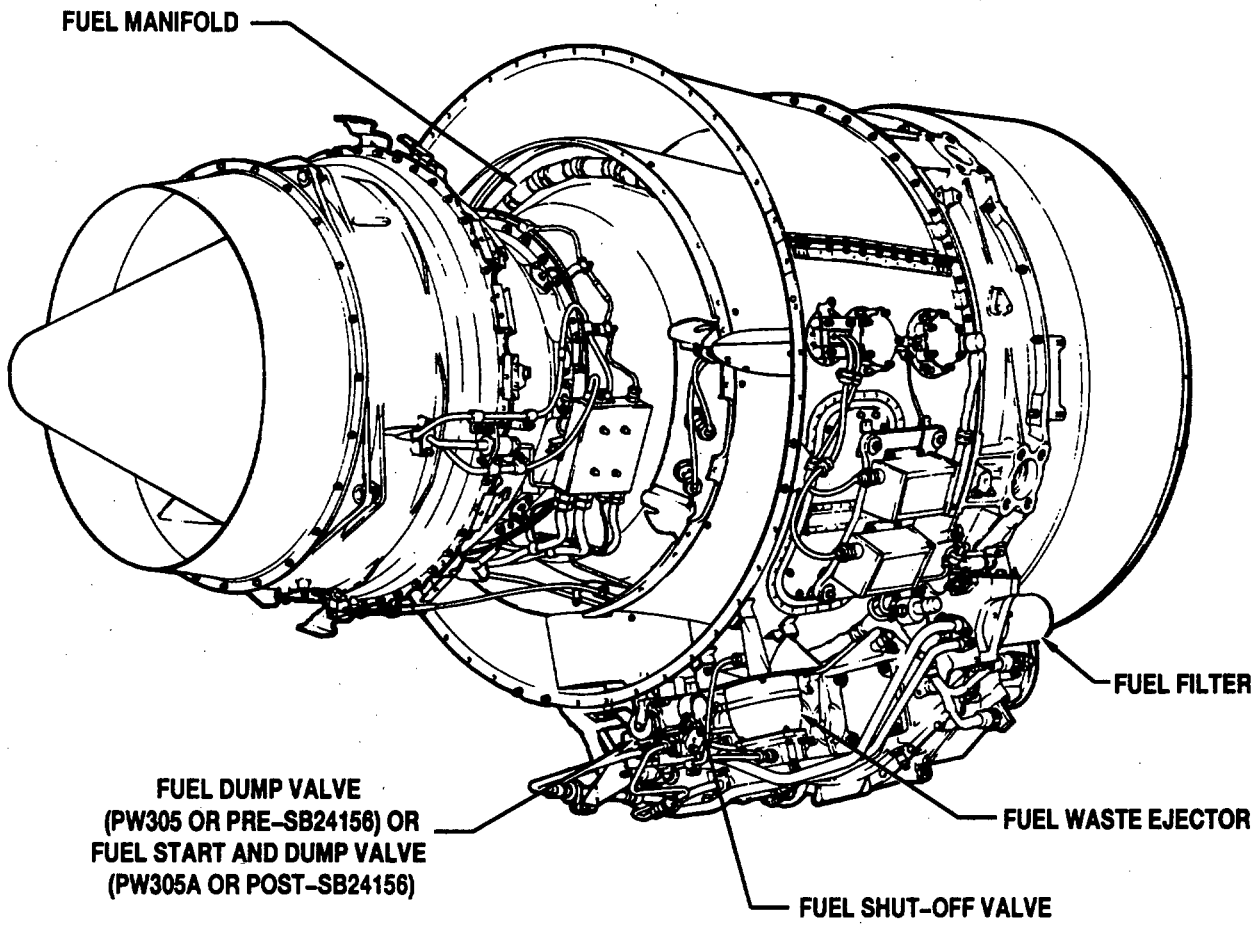
Fuel System Components
Figure 3 (Sheet 1 of 2)



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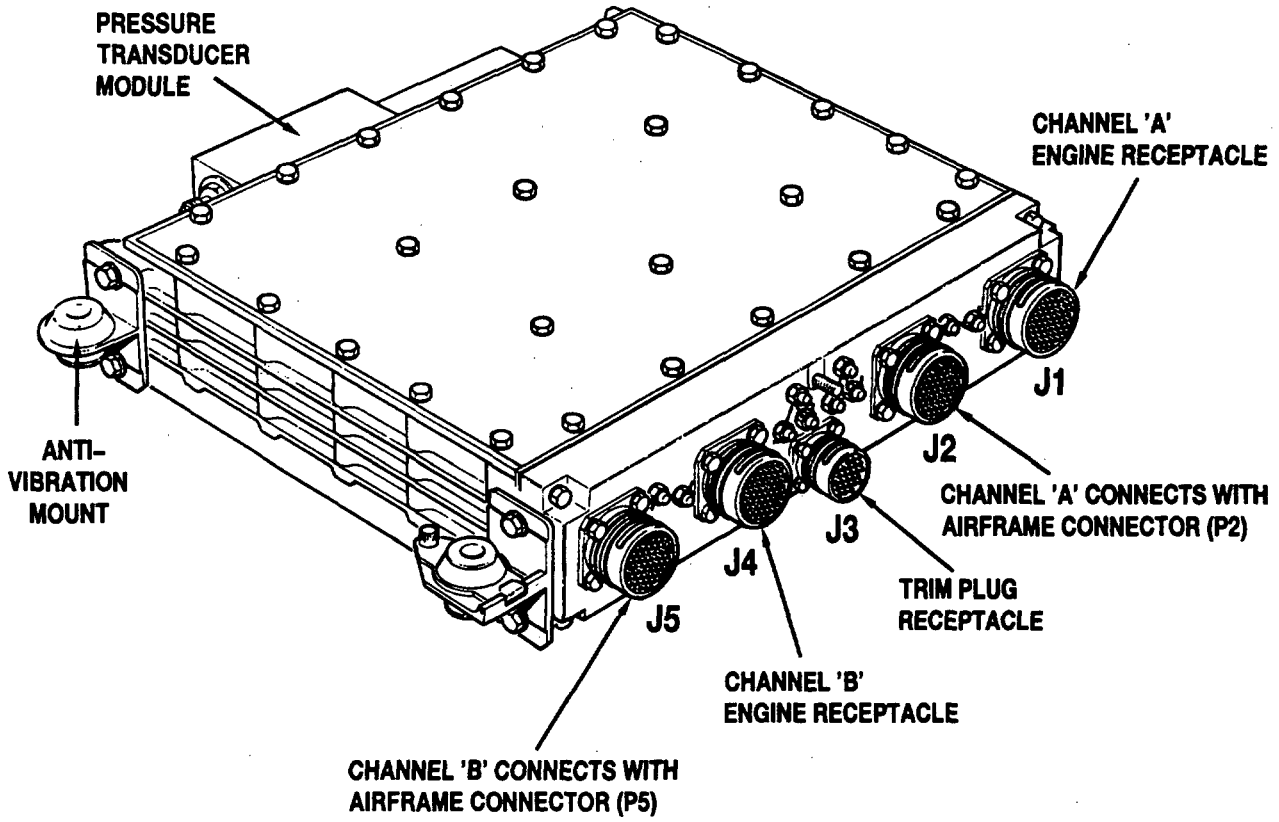
Fuel System Components
Figure 3 (Sheet 2)



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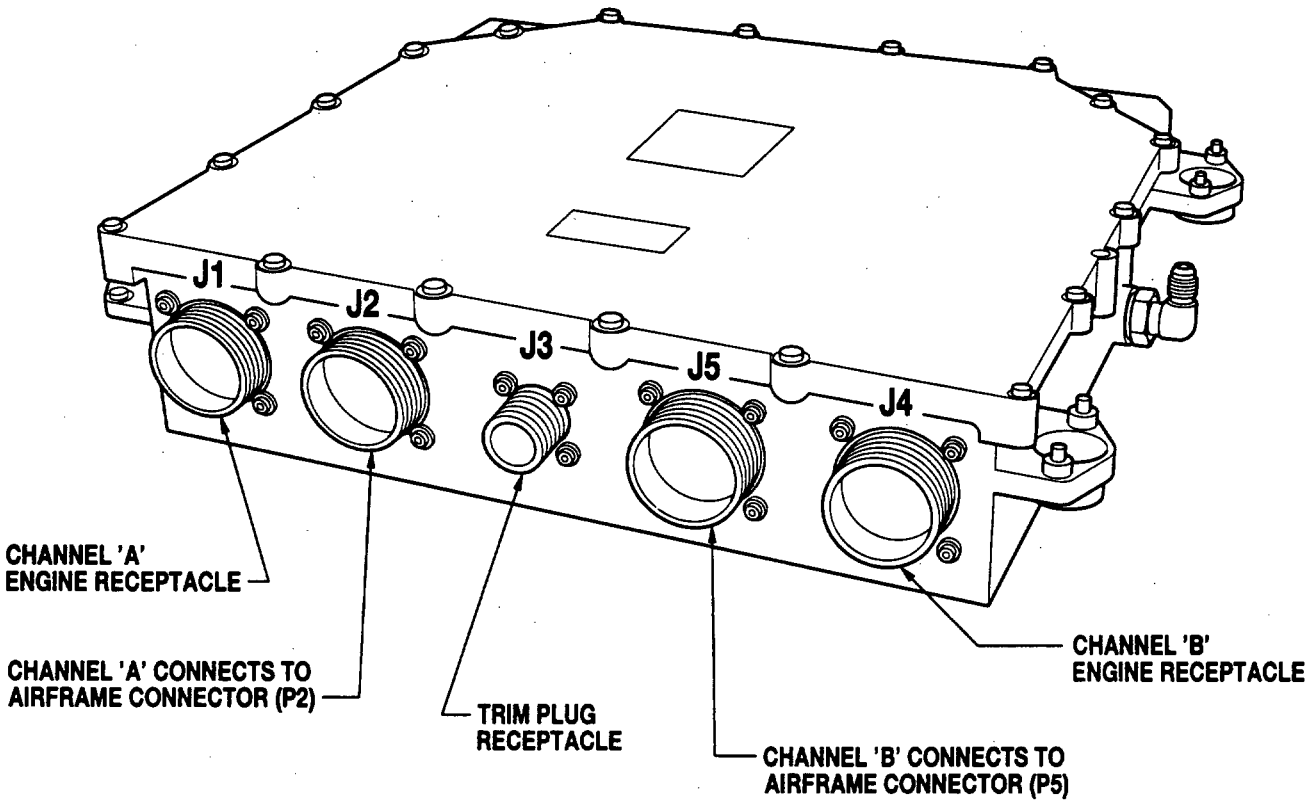
Electronic Engine Control
Figure 4 (Sheet 1 of 2)



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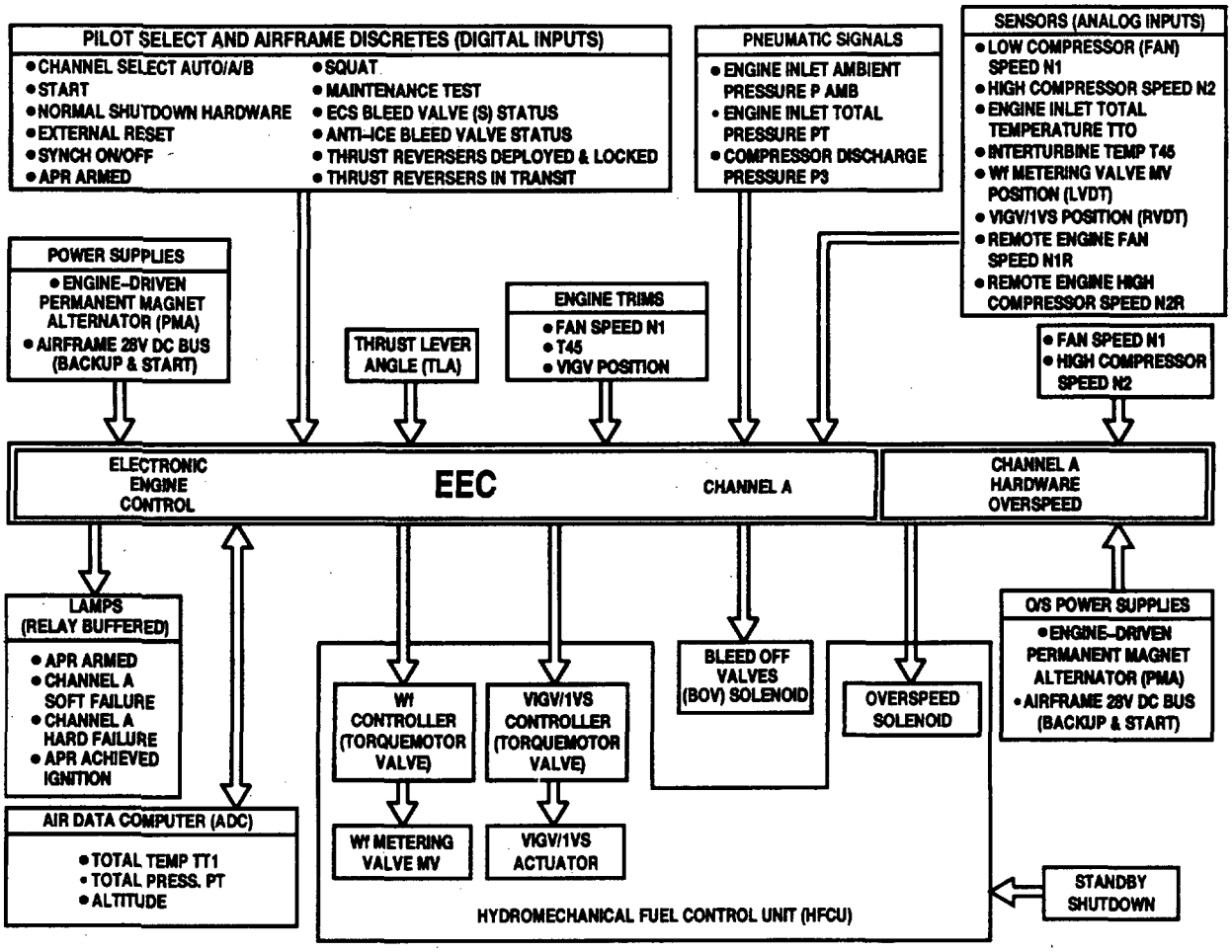
Electronic Engine Control
Figure 4 (Sheet 2)


PILOT SELECT AND AIRFRAME DISCRETES (DIGITAL INPUTS)
• CHANNEL SELECT AUTO/A/B
• START
• NORMAL SHUTDOWN HARDWARE
• EXTERNAL RESET
• SYNCH ON/OFF
• APR ARMED
• SQUAT
• MAINTENANCE TEST
• ECS BLEED VALVE (S) STATUS
• ANTI-ICE BLEED VALVE STATUS
• THRUST REVERSERS DEPLOYED & LOCKED
• THRUST REVERSERS IN TRANSIT
PNEUMATIC SIGNALS
• ENGINE INLET AMBIENT PRESSURE P AMB
• ENGINE INLET TOTAL PRESSURE PT
• COMPRESSOR DISCHARGE PRESSURE P3
SENSORS (ANALOG INPUTS)
• LOW COMPRESSOR (FAN) SPEED N1
• HIGH COMPRESSOR SPEED N2
• ENGINE INLET TOTAL TEMPERATURE TTO
• INTERTURBINE TEMP T45
• Wf METERING VALVE MV POSITION (LVDT)
• VIGV/1VS POSITION (RVDT)
• REMOTE ENGINE FAN SPEED N1R
• REMOTE ENGINE HIGH COMPRESSOR SPEED N2R
POWER SUPPLIES
• ENGINE-DRIVEN PERMANENT MAGNET ALTERNATOR (PMA)
• AIRFRAME 28V DC BUS (BACKUP & START)
THRUST LEVER ANGLE (TLA)
ENGINE TRIMS
• FAN SPEED N1
• T45
• VIGV POSITION
• FAN SPEED N1
• HIGH COMPRESSOR SPEED N2
ELECTRONIC ENGINE CONTROL
EEC
CHANNEL A
CHANNEL A HARDWARE OVERSPEED
LAMPS (RELAY BUFFERED)
• APR ARMED
• CHANNEL A SOFT FAILURE
• CHANNEL A HARD FAILURE
• APR ACHIEVED IGNITION
AIR DATA COMPUTER (ADC)
• TOTAL TEMP TT1
• TOTAL PRESS. PT
• ALTITUDE
Wf CONTROLLER (TORQUEMOTOR VALVE)
VIGV/1VS CONTROLLER (TORQUEMOTOR VALVE)
Wf METERING VALVE MV
VIGV/1VS ACTUATOR
BLEED OFF VALVES (BOV) SOLENOID
OVERSPEED SOLENOID
O/S POWER SUPPLIES
• ENGINE-DRIVEN PERMANENT MAGNET ALTERNATOR (PMA)
• AIRFRAME 28V DC BUS (BACKUP & START)
STANDBY SHUTDOWN
HYDROMECHANICAL FUEL CONTROL UNIT (HFCU)

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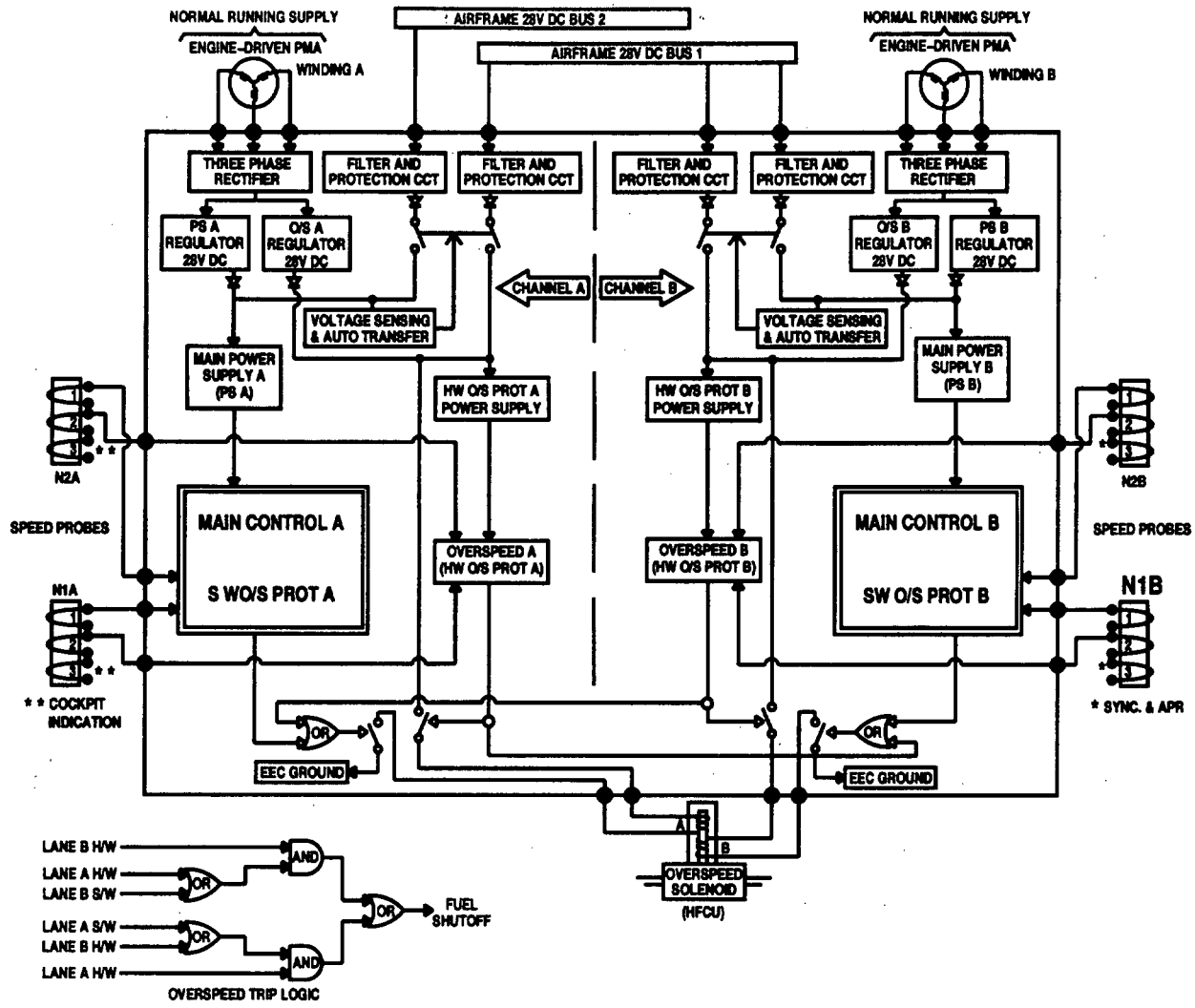
EEC Interface Block Diagram (One of Two Channels Shown)
Figure 5



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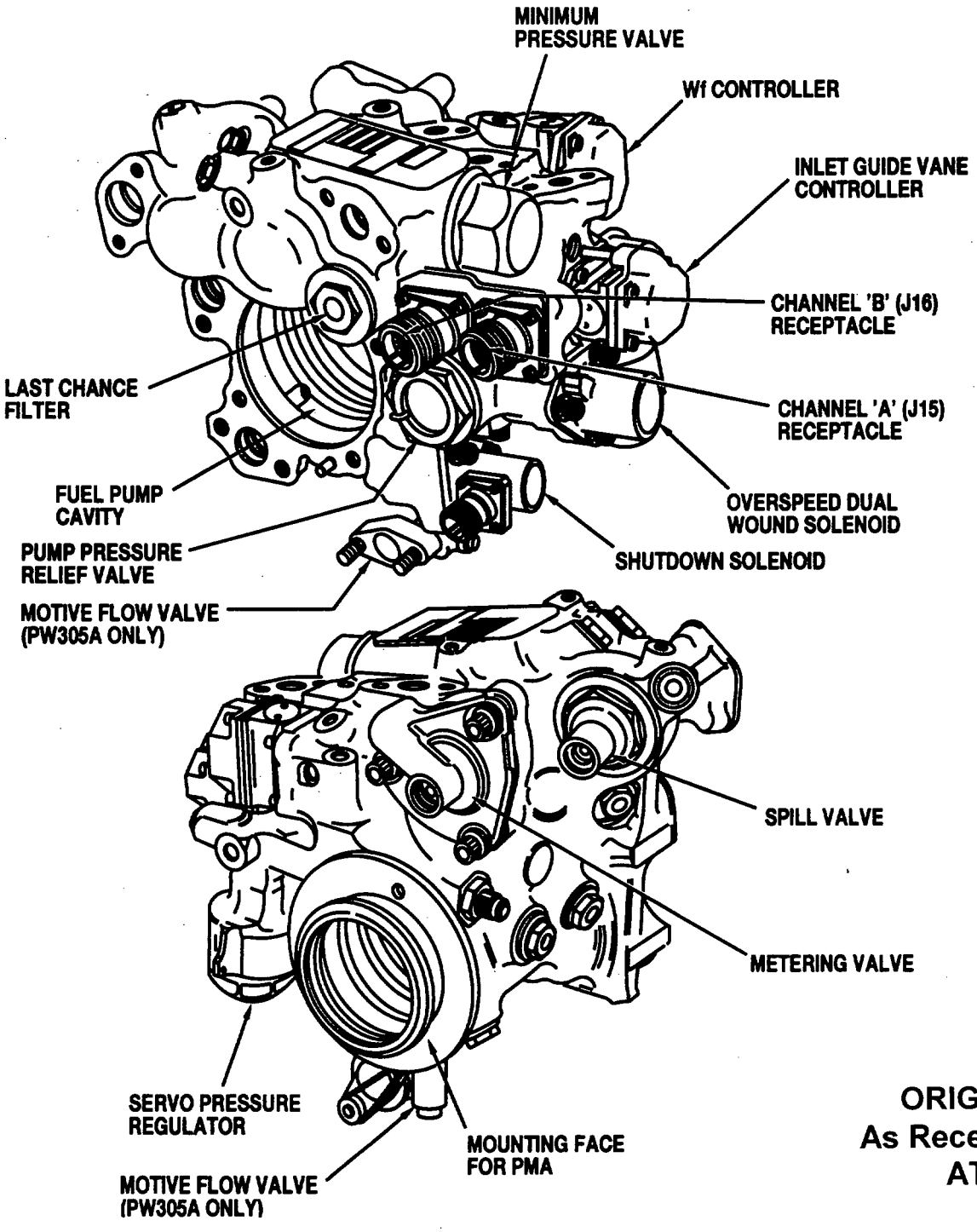
EEC Power Sources, Automatic Transfer and Electronic Overspeed Protection - Block Diagram
Figure 6



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Hydromechanical Metering Unit
Figure 7

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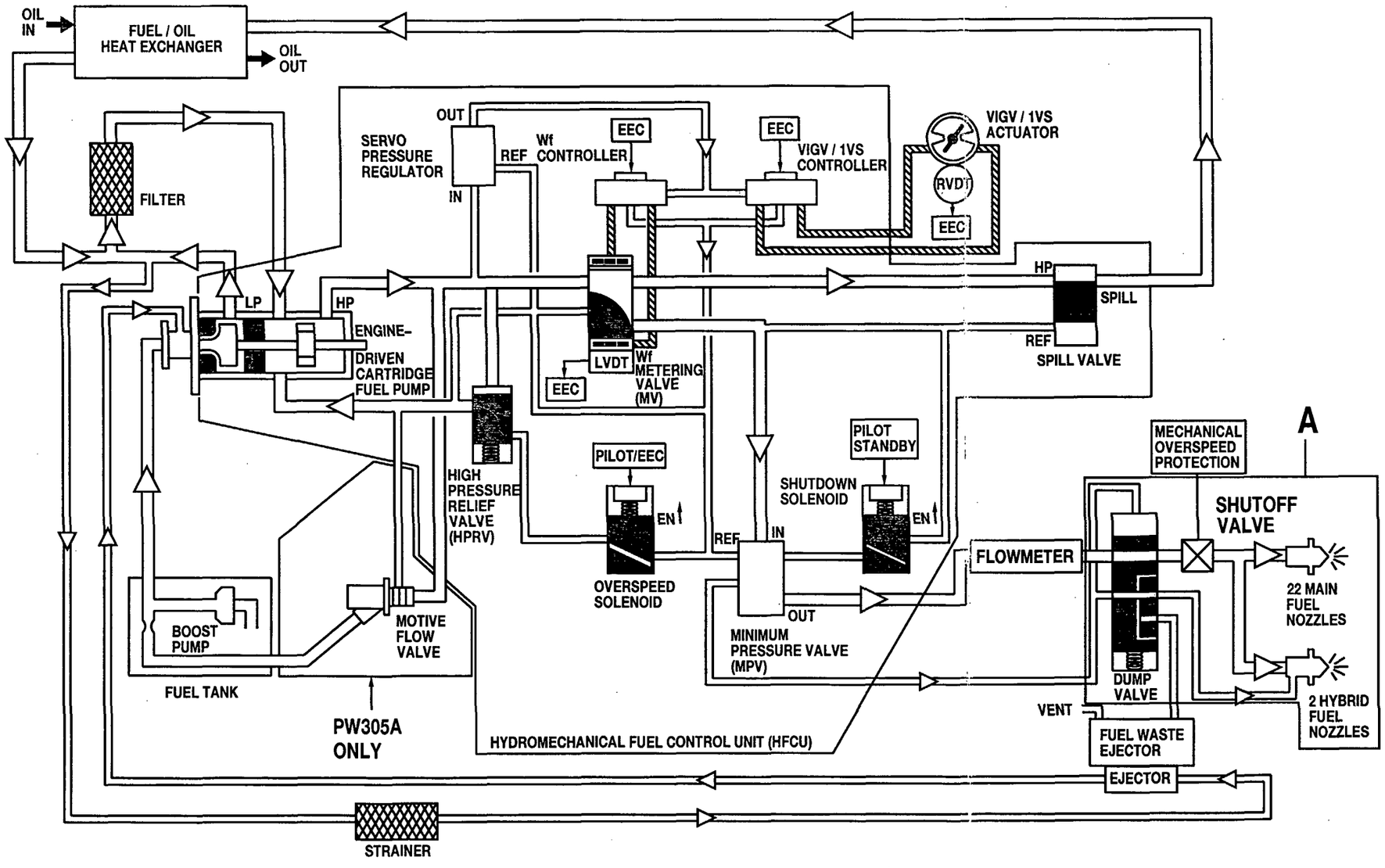
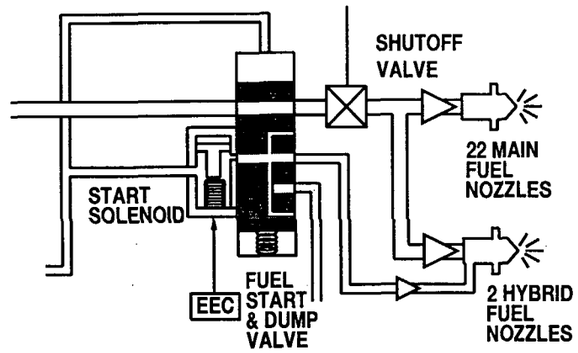




PW305A OR POST-SB24156
VIEW A

C18228C

Fuel System - Schematic
Figure 8

A. Calculation of Required N1 (Ref. Fig. 5)

Calculated required N1 is dependent on:

(1) Thrust Lever Angle (TLA)

TLA is conveyed to each EEC channel via separate rotary variable differential transformer (RVDT) position transducers excited by EEC.

(2) Pilot Select and Airframe Discretes

These digital inputs are switches, either pilot-actuated to select operating modes for EEC, or airframe-actuated status indications to condition programming within EEC.

(3) Sensors

Several sensors send analog feedback signals to the EEC.

(4) Pneumatic Signals

Raw pneumatic signals (P1 and P3) are sensed by the EEC and are converted to electrical signals within the EEC.

(5) Engine Trims

Plug-in trims provide means of compensating for sensing error on selected analog signals.

B. N1 and N2 Electronic Overspeed Protection (Ref. Figs. 6 and 8)

Four electronic overspeed protection systems (two software and two hardware) are provided for the two rotors:

(1) Software Overspeed Protection (SW O/S PROT)

Each rotor is protected by two independent EEC software overspeed systems. EEC will not permit either engine rotor to exceed 102% during normal operation. Should 105% be attained by either rotor, EEC software will send an engine trip command to overspeed shutdown logic (Ref. step (3), following).

(2) Hardware Overspeed Protection (HW O/S PROT)

Each rotor is also protected by two hardware shutdowns physically located within EEC but independent of EEC software. Should 110% be attained by either rotor, HW O/S PROT will send trip command to overspeed shutdown logic (Ref. Step (3) following).

(3) Overspeed Shutdown Logic

To prevent engine tripping due to malfunction of a single channel, two or more channels must have tripped and, of these channels, at least one must be a HW O/S PROT channel. If overspeed logic demands an engine trip via the overspeed solenoid (Ref. Fig. 8), the EEC software will command Wf metering valve (MV) to close as a backup to the overspeed solenoid.

C. Engine Shutdown (Ref. Figs. 5 and 8)

(1) Normal Shutdown (Ref. Fig. 5)

Preferred shutdown is effected by simultaneous switch closures on both channel A and B discrete inputs "Normal Shutdown Hardware". This will depress HW O/S PROT datums, therefore simulating overspeed. The EEC will then energize both coils of the overspeed solenoid in the HMU (Ref. Fig. 8) to ultimately stop burn fuel flow. Upon initiation of normal shutdown, EEC main control (software) is simultaneously informed that HW O/S PROT's are attempting to shut down the engine. Both main controls will thus expect to see N2 decreasing; if after 5 seconds this does not occur, main control of the channel in control will close Wf metering valve (MV) in the HMU to terminate burn fuel flow.

(2) Standby Shutdown (Ref. Fig. 8)

Standby shutdown provides an alternative means of shutting down the engine which is independent of EEC action. If the pilot selects this method of shutdown (via fire handle), power is directly applied to the shutdown solenoid in the HMU. Action of the overspeed solenoid to terminate burn fuel flow is described in Para. 4. C.

D. Power Supplies to EEC (Ref. Fig. 6)

The EEC is normally supplied by a single engine-driven, dual winding, three phase permanent magnet alternator (PMA) mounted directly on the accessory gearbox (AGB). Each PMA winding supplies power to an EEC channel. Within each channel, PMA supply is rectified, then fed to two regulators. One regulator feeds the main power supply for EEC main control (software); the other feeds the power supply for hardware overspeed protection (HW O/S PROT).

For each channel, a voltage sensing circuit monitors incoming source to source to main power supply. For Channel A only, if the source is less than 18 VDC, main control A is automatically switched to airframe 28 VDC Bus 2. HW O/S PROT A is simultaneously switched to airframe 28 VDC Bus 1. For Channel B, when source is less than 18 VDC, both main control B and HW O/S PROT B are automatically switched over to airframe Bus 1.

Airframe busses are normal supplies for engine starting and act as back-up sources in event of loss of PMA-derived power.

4. Hydromechanical Fuel Control Unit (HFCU or HMU) (Ref. Figs. 7 and 8)

The HMU is an electro-hydraulic transducer which changes EEC electrical signals to fuel flow. The HFCU regulates burn fuel flow, positions HP compressor inlet variable geometry, shuts down the engine during normal and abnormal circumstances and provides high and low fuel pressure protection.

A. Regulation of Burn Flow

Aircraft boost pump(s) supply fuel to an engine-driven two stage, cartridge-style pump inserted into the HFCU body. LP fuel from the first (centrifugal) stage passes through an external 10 micron filter, then returns to the inlet of the second (vane) stage of the fuel pump. HP fuel leaving the second-stage is routed to the Wf metering valve (MV). HP fuel is also supplied to a servo pressure regulator. EEC output (fuel demand) is, in effect, an MV position demand. The EEC electrical signal drives a torquemotor within the Wf controller which, in turn, positions a spool valve. Regulated servo pressure is then converted into two hydraulic signals which position MV. Wf controller has redundant windings - one for Channel A, the other Channel B. Either will modulate servo pressure to position MV. There is no mechanical minimum flow position for MV; Minimum position is dictated by EEC software.

Temperature compensation is effected within the MV by a valve and ported sleeve. A linear variable differential transformer (LVDT)-type transducer feeds MV position back to the EEC. Excitation power for LVDT is provided by the EEC.

To keep the relationship between EEC demand and resultant fuel flow constant regardless of fuel pump pressure variation, pressure differential across the MV is held constant by the spill valve. HP fuel from the upstream side of the MV is spilled so as to maintain 50 psid above downstream pressure. Spilled fuel passes through the fuel/oil heat exchanger where it is warmed by heat rejected from engine oil. Spill fuel then passes through the fuel filter before it enters the inlet of the fuel pumps second-stage.

B. Positioning of HP Compressor Geometry

Variable Inlet Guide Vanes (VIGV) and first-stage variable stators (1VS) are mechanically linked together and are automatically positioned to achieve peak compressor efficiency without encountering compressor surge. Optimum vane angle is computed by the EEC in response to certain sensors, pneumatic feedbacks and discretes (Ref. Fig. 5) and is sent to HFCU as an electrical signal. This VIGV/1VS position demand signal energizes one of two windings of the VIGV/1VS controller (A or B, whichever EEC channel is controlling). This torquemotor valve alters the two hydraulic signals going to the VIGV/IVS actuator. The resultant differential pressure across the actuator vanes drives the actuator output shaft. A rotary variable differential transformer (RVDT)-type position transducer feeds back actuator position to EEC. When feedback matches demand, the controller equalizes the hydraulic signals and actuator movement ceases. Hydraulic signals are derived from regulated servo pressure.

C. Engine Shutdown

Preferred engine shutdown is by electronic overspeed simulation. This will energize the overspeed solenoid which redatums the high pressure relief valve (HPRV) such that it relieves at a lower pressure than minimum pressure valve (MPV) setting, causing MPV to close and fuel flow to engine nozzles to terminate.

If the pilot elects to stop the engine without utilizing EEC, a standby shutdown (via fire lever) is available which will directly energize the shutdown solenoid. This redatums the spill valve such that all flow passes through it. System pressure then falls below MPV set point; MPV closes and fuel flow to engine nozzles is terminated.

D. Underpressure and Overpressure Protection

All metered flow passes through the Minimum Pressure Valve (MPV) before it leaves the HFCU enroute to the fuel nozzles. This valve ensures that fuel pressure within the HFCU is high enough (300 psid) to allow proper functioning of HFCU hydraulic circuits. If minimum pressure is not maintained, MPV closes fully to terminate burn fuel flow. A tapping from MPV supplies lightoff (primary) fuel to the two hybrid fuel nozzles.

A high pressure relief valve (HPRV) is incorporated to fully open at 1310 psid to prevent overstressing HFCU and fuel pump by bypassing fuel back to the inlet of the fuel pump's second stage.

5. Fuel Pump (Ref. Fig. 9)

The fuel pump is a cartridge-type unit which can be extracted from the HMU without disassembly.

The pump uses a high pressure vane stage and a centrifugal boost stage. Power is received from the Accessory Gearbox (AGB) by a coupling shaft driving the HP rotor/shaft which, in turn, drives the centrifugal pump.

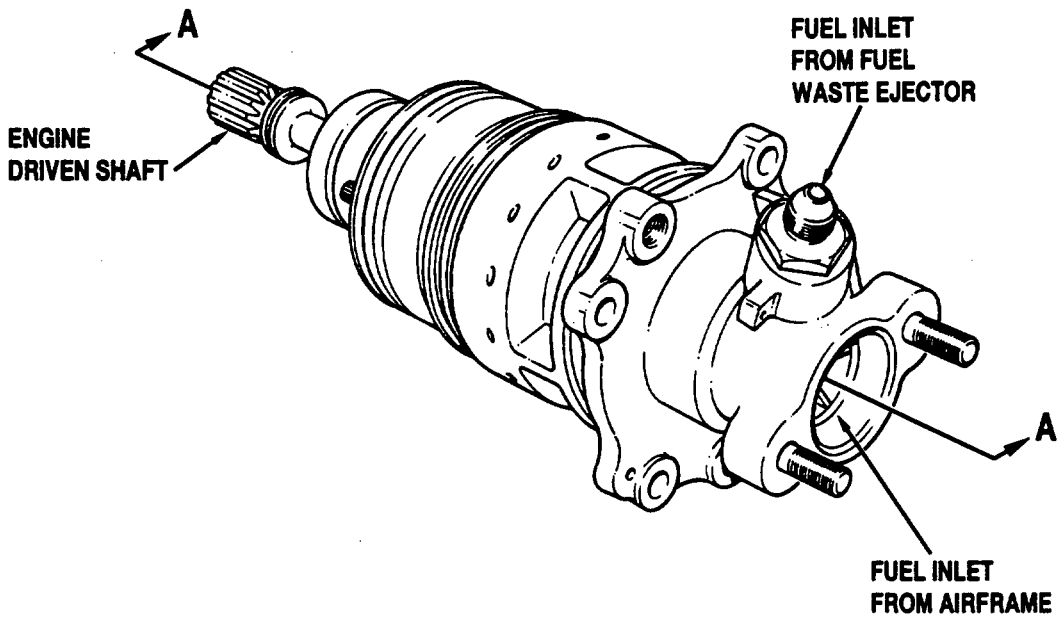
6. Fuel Manifold (Ref. Fig. 10)

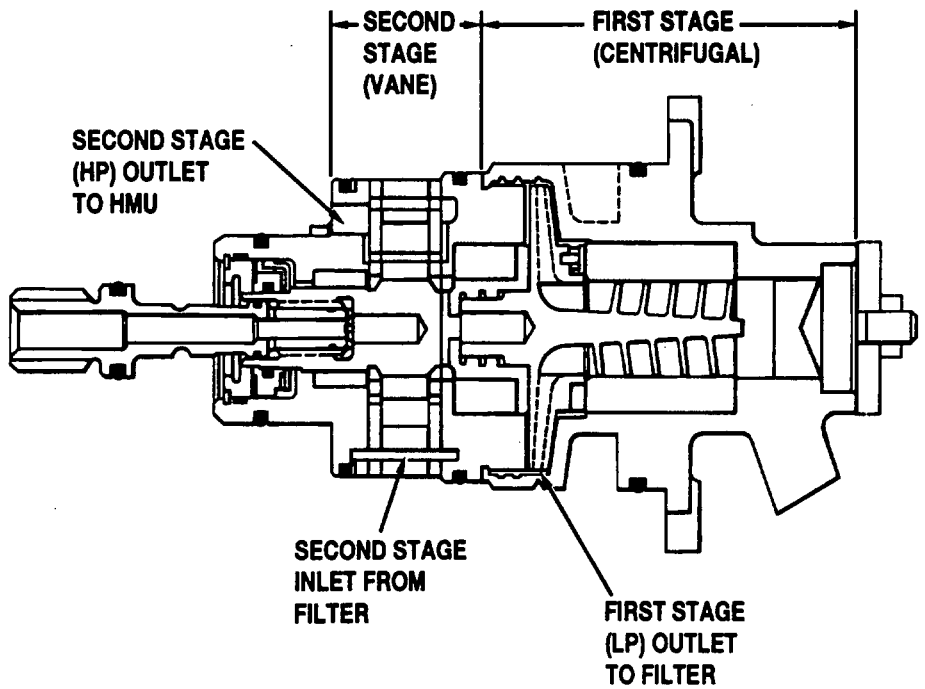
The fuel manifold distributes secondary fuel to the engine combustion chamber and consists of 1 inlet fuel nozzle, 21 secondary fuel nozzles, 2 hybrid (primary and secondary) fuel nozzles and interconnecting transfer tubes.

Secondary fuel is admitted to the fuel manifold via the single inlet fuel nozzle. The inlet fuel nozzle and the 21 secondary fuel nozzles are simple air blast fuel atomizers, relying on the flow of P3 air through the combustion chamber liner for atomization.

The 2 hybrid fuel nozzles are located adjacent to the 2 engine igniter plugs and are basically secondary fuel nozzles modified to also admit primary fuel. The hybrid nozzles atomize primary fuel using fuel pressure and secondary fuel using air blast.

Primary fuel is supplied to the hybrid nozzles by a separate stainless steel fuel line, originating at the lower bypass duct next to the inlet fuel nozzle and running along the combustor outer case, adjacent to the secondary fuel manifold. Primary fuel flow remains on during normal engine operation.





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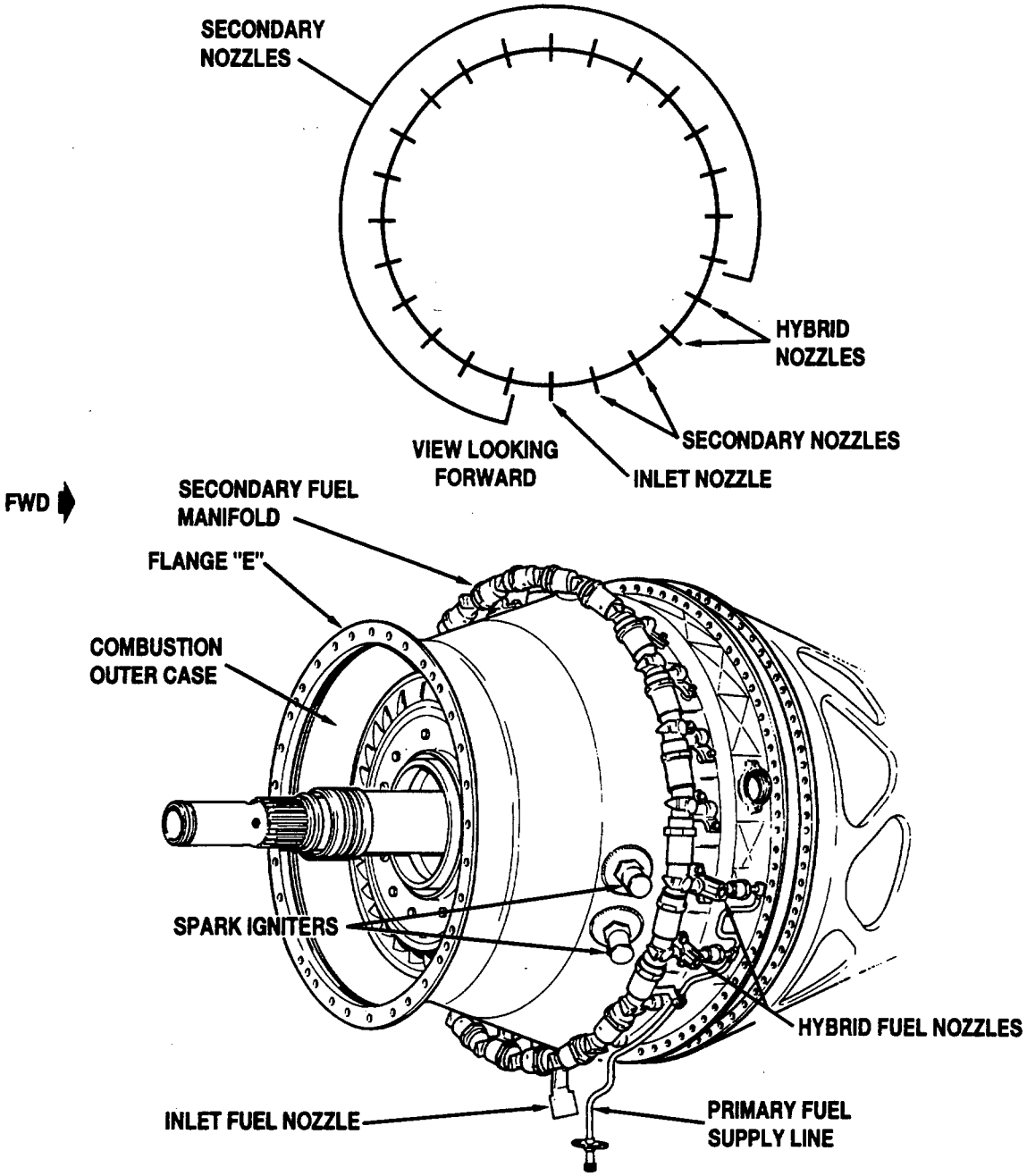
Fuel Pump
Figure 9



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Fuel Manifold
Figure 10

7. Fuel Dump Valve (Pre-SB24156) (Ref. Fig. 11)

The fuel dump valve assembly is mounted with the fuel shut-off mechanism at the 6 o'clock position on the outer bypass duct. The function of the dump valve is to deliver metered fuel to the primary and secondary fuel manifolds and to dump residual fuel from the manifolds into the fuel waste ejector at engine shut down. The dump valve consists of a valve operating in a ported sleeve, held in the closed or dump position by a spring loaded piston. Five fuel flow connections are provided on the dump valve housing. The primary and secondary outlet ports are on the top face, while primary and secondary inlet ports are located on one side face. A dump port is located on the bottom face.

During engine start-up, fuel is initially delivered by the HFCU to the primary inlet port. The primary fuel pressure overcomes the spring force and moves the valve, opening the primary and secondary inlet and outlet ports and closing the outlet to the dump port. Both primary and secondary fuel flows at engine idle and above. At engine shut down, fuel pressure ceases and spring pressure moves the valve to block the inlet ports. The dump port is now open to allow residual fuel in the manifold to drain to the fuel waste ejector.

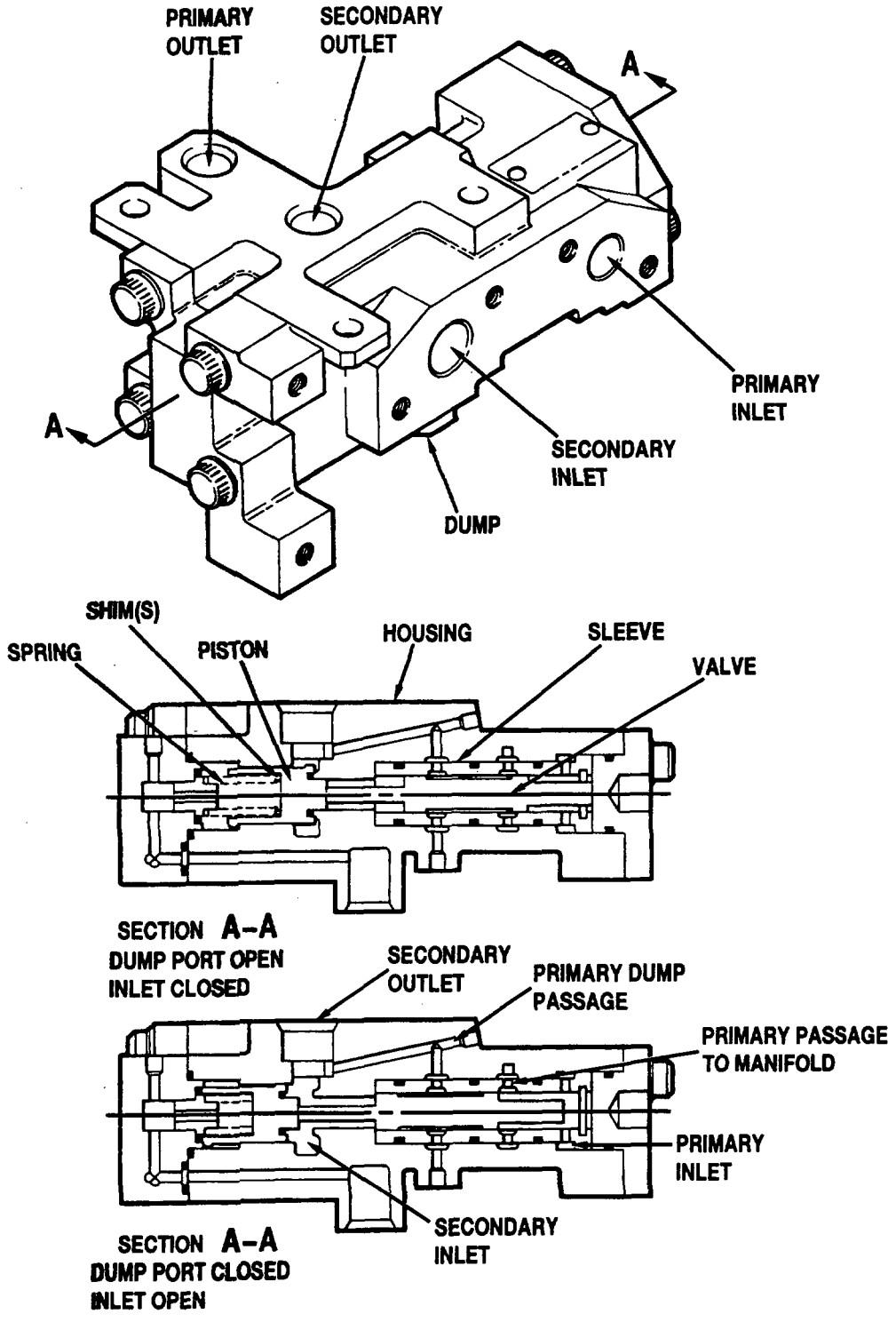
8. Start and Fuel Dump Valve (PW305A or Post-SB24156)

The dump valve feature in this assembly functions the same as the Pre-SB24156 dump valve. A starting fuel solenoid valve is integrated into the assembly, which schedules the supply of primary fuel from the HFCU to the hybrid nozzles during the starting cycle. During engine start-up, primary fuel is delivered by the HFCU to the primary inlet port. After light-up, when T4.5 reaches a preset temperature in the EEC, primary fuel is cut-off and the primary inlet port is connected to the secondary fuel, which now supplies fuel to both primary and secondary inlet ports. When the start valve is de-energized by the EEC, fuel is supplied to the hybrid nozzles by the secondary fuel supply.

9. Fuel Waste Ejector (Ref. Fig. 12)

The fuel waste ejector is mounted at the 6 o'clock position on the engine, below the fuel dump valve. The waste ejector consists of a tank with inlet and outlet connections and a vent. The tank contains non-return valves, a motive flow ejector pump, a strainer and a float operated drain valve. The function of the waste ejector is to reduce atmospheric pollution and reduce fuel waste by returning fuel from the fuel dump valve to the fuel pump inlet as burn fuel.

During engine operation, LP fuel from the HFCU is ported to the inlet of the waste ejector; the fuel flow through the unit creates a venturi effect at the bottom of the ejector. When a sufficient amount of fuel from previous shutdowns has drained into the tank assembly the float will rise, causing a valve to unseat from an orifice. Fuel pressure acting on top of the orifice assembly together with the pressure drop at the bottom, opens a non-return valve located at the bottom of the orifice. Fuel is then drawn from the tank and conveyed to the inlet side of the fuel pump. When the tank fuel level drops, the float moves down and the orifice is covered by the valve. The non-return valve then closes, preventing fuel from the HFCU from entering the tank via the orifice.



C18557

Fuel Dump Valve
Figure 11

10. Motive Flow Valve (PW305A)

The motive flow valve is bolted on the HFCU.The valve is a pressure regulator component which controls the high pressure fuel flow from the engine-driven fuel pump and route the fuel back to the ejector pump in the aircraft fuel tank. An EEC controlled solenoid is integrated in the motive flow system to control the on/off operation of the valve. A switch in the cockpit however, can over-ride the operation of the valve through the EEC.

11. Emergency Fuel Shut-off (Ref. Fig. 13)

A. Emergency Fuel Shut-off Actuating Mechanism

In the event of LP turbine shaft breakage (shear), the resultant axial rearward displacement of the shaft will actuate an automatic trigger mechanism which, via levers and cables, will actuate the fuel shut-off valve to terminate secondary fuel flow to the fuel manifold and thus prevent overspeed of the LP turbine assembly.

During normal operation, the actuating rod of the trigger mechanism is in close proximity to the LP turbine shaft. Actuating rod position is mechanically translated to normal (open) position on the fuel shut-off valve.

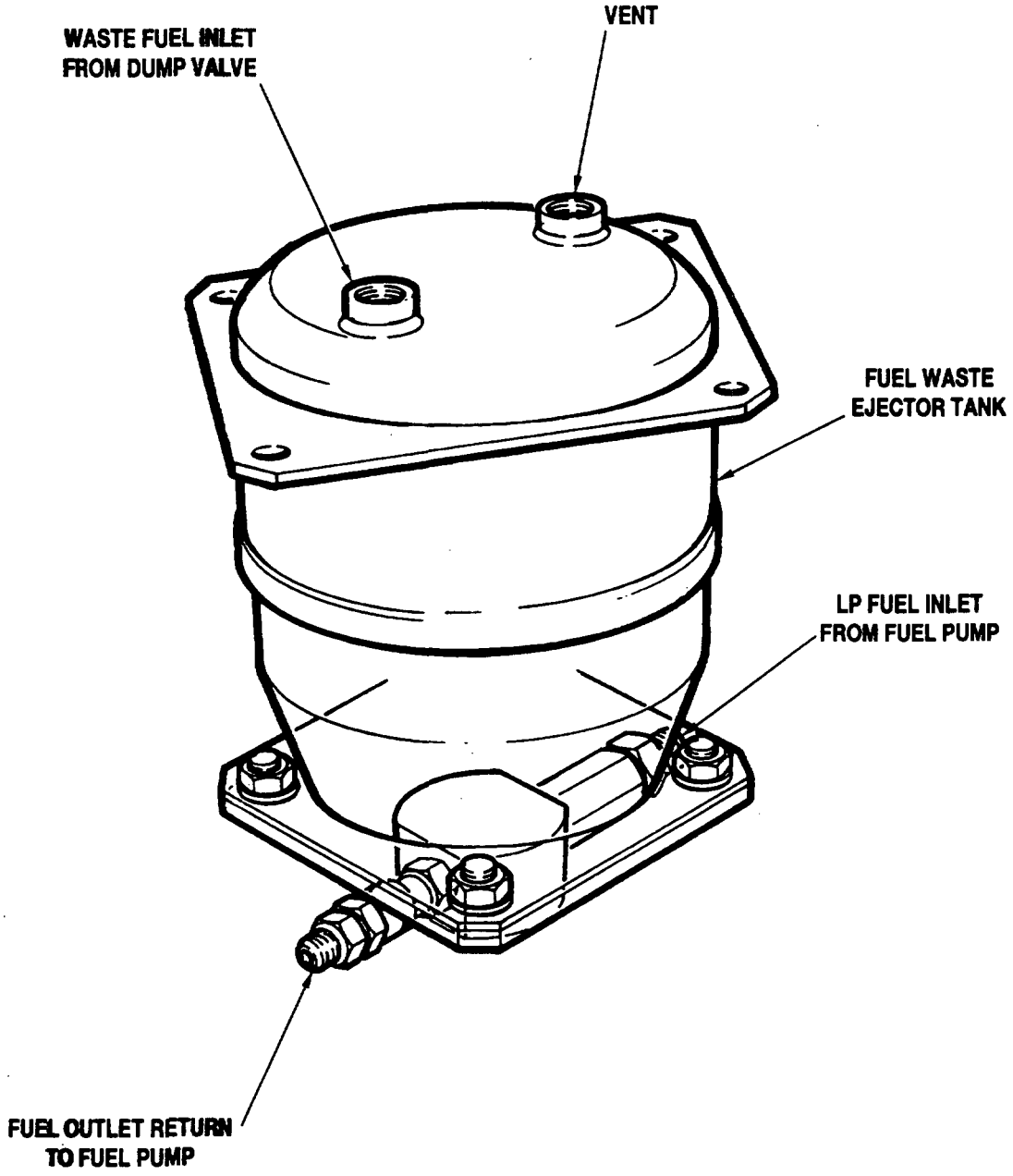
B. Fuel Shutoff Valve

In the normal position, fuel passes to the fuel manifold through the inlet port in the fuel shut-off valve piston assembly. A set of spring washers loaded against the piston seat, keeps the piston firmly butted against the head of the release plate. The release plate is restrained by shoulders formed on the inner faces of two pivoted control levers. These levers are prevented from moving apart by a counterbore in the head of cup-shaped tripper sleeve assembly, which engages the tips of the levers. A spring which encircles the tripper sleeve assembly bears against a circumferential shoulder on the tripper sleeve at one end and against the cover at the other end. Mating mirror-image profiles on the inner faces of the control levers afford clearance for a pin installed diametrically across the open end of the tripper sleeve.

A lug formed on the head of the tripper sleeve projects through the cover to connect with the overspeed control lever, which forms the final element of a mechanical linkage between the fuel shut-off valve and the overspeed actuating rod installed in the exhaust case.

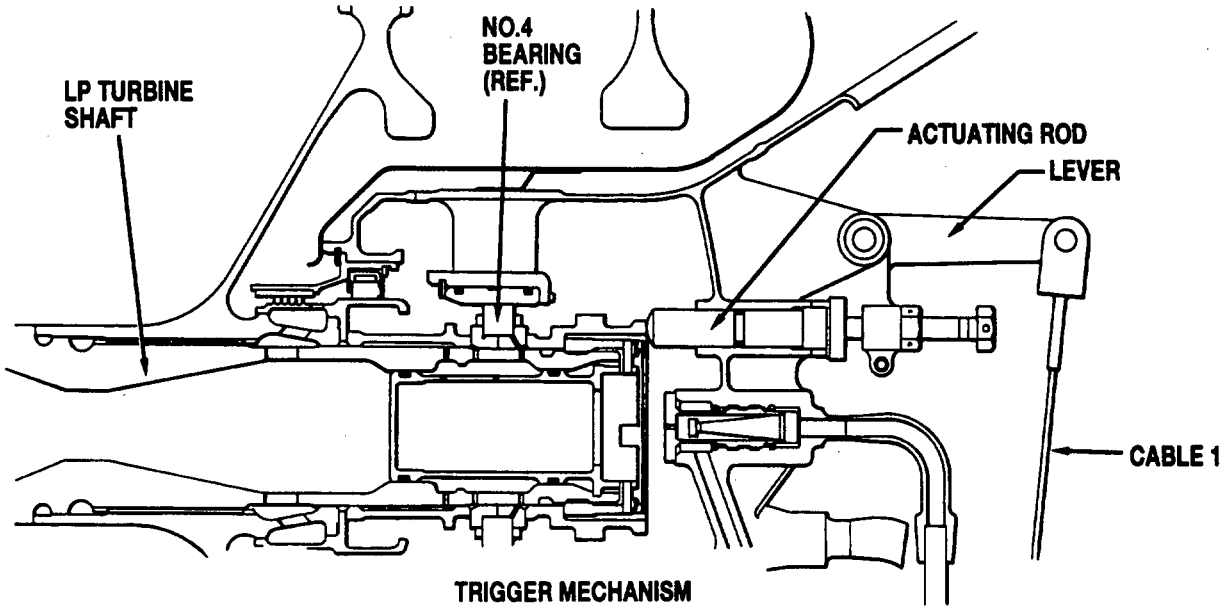
Axial rearward displacement of the turbine shaft acts through mechanical linkages to draw the tripper sleeve against the compression spring. If this movement exceeds the permitted amount, the counterbore of the tripper sleeve is drawn clear of the tips of the pivoted cam surfaces of the pivoted control levers, and rotates the levers on their pivots. This allows the release plate to pass between the control levers as the shut-off valve piston moves to the right under the action of the spring washers and fuel pressure.

Displacement of the shut-off valve piston carries the inlet port out of register with the fuel passage in the fuel manifold inlet, substituting a second port which is closed at the outlet side by the shut-off valve. Fuel pressure acting on the stem of the valve presses it firmly against the open end of the delivery passage to cut off flow to the fuel manifold.

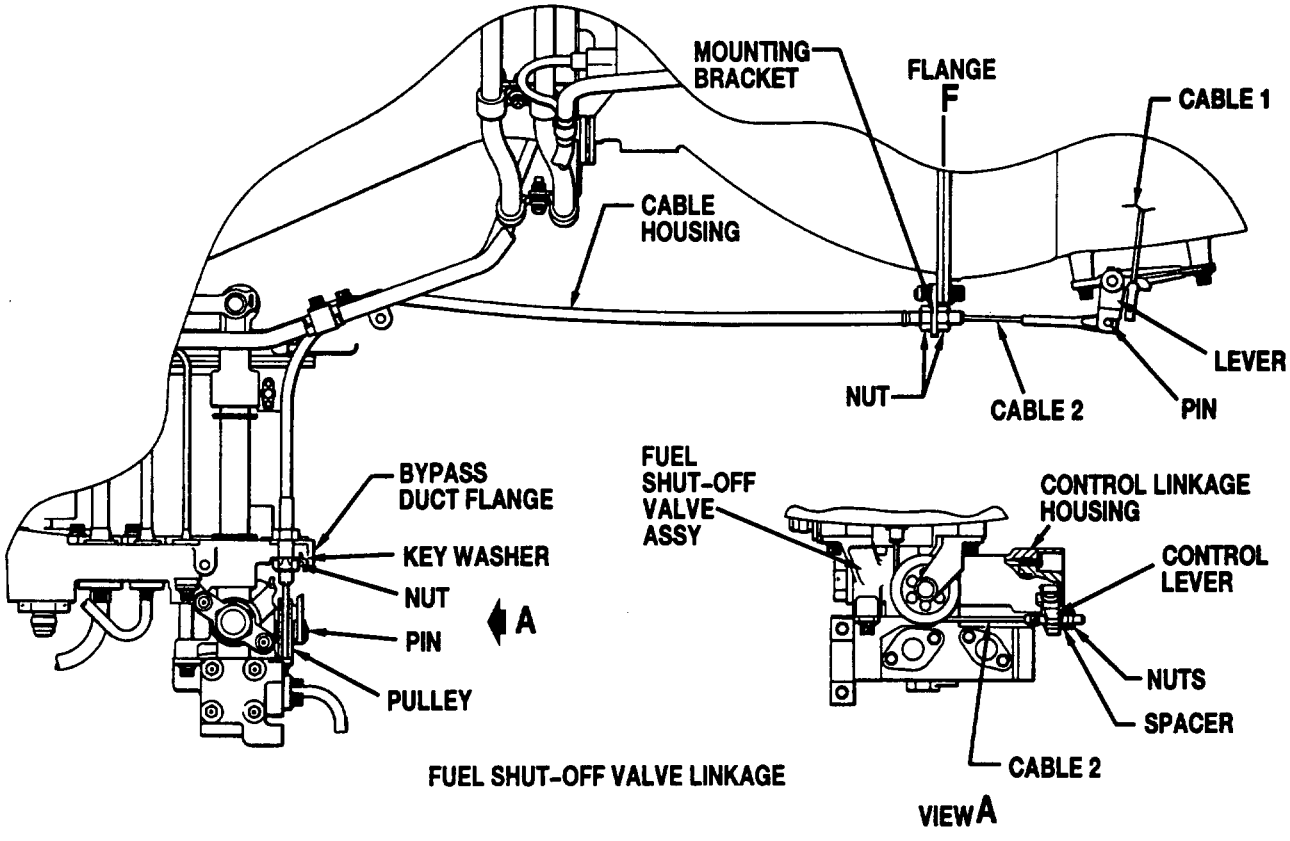


C19738

Fuel Waste Ejector
Figure 12



TRIGGER MECHANISM



FUEL SHUT-OFF VALVE LINKAGE

C18755

Emergency Fuel Shut-off Valve and Actuating Mechanism
Figure 13

The fuel shut-off valve is not self-resetting.

12. Wiring Harnesses (Ref. Figs. 14 thru 18)

Three separate wiring harnesses are utilized on the PW305 engine; the Rear Core, the Front Core and the Outer Wiring Harnesses.

Pin/socket arrangement for connectors is shown on Figure 18 and Tables 1 and 2. Similar connectors are keyed to ensure correct installation of harness to end device.

A. Rear Core Harness (Ref. Fig. 15)

The rear core harness consists of three separate multi-conductor leads protected by flexible and rigid conduit. These conductors bring N1 speed sensing signals and T45 thermocouple outputs from the N1/T45 terminal box mounted on the right side of the engine on Flange E to two separate receptacles (J27 and J28) mounted on the outer bypass duct i.e. the harness connects engine rear core (internal) devices to external receptacles.

B. Front Core Harness (Ref. Fig. 16)

The front core harness connects front core (internal) devices to two external receptacles (J29 and J30) mounted on the outer bypass duct on either side of the engine.

Quick-disconnect connectors are used at end devices and, where necessary, are keyed to ensure correct connection of the harness to end devices.

The harness is suitably insulated, shielded and overbraided for mechanical protection.

C. Outer Wiring Harness (Ref. Fig. 17)

The outer wiring harness consists of a complex cable assembly which connects the front and rear harnesses to engine components outside the outer bypass duct and interfaces with the airframe. It is suitably insulated, shielded and is equipped with quick-disconnects for each end device.

TABLE 1, "P" Connector Identification - Wiring Harness

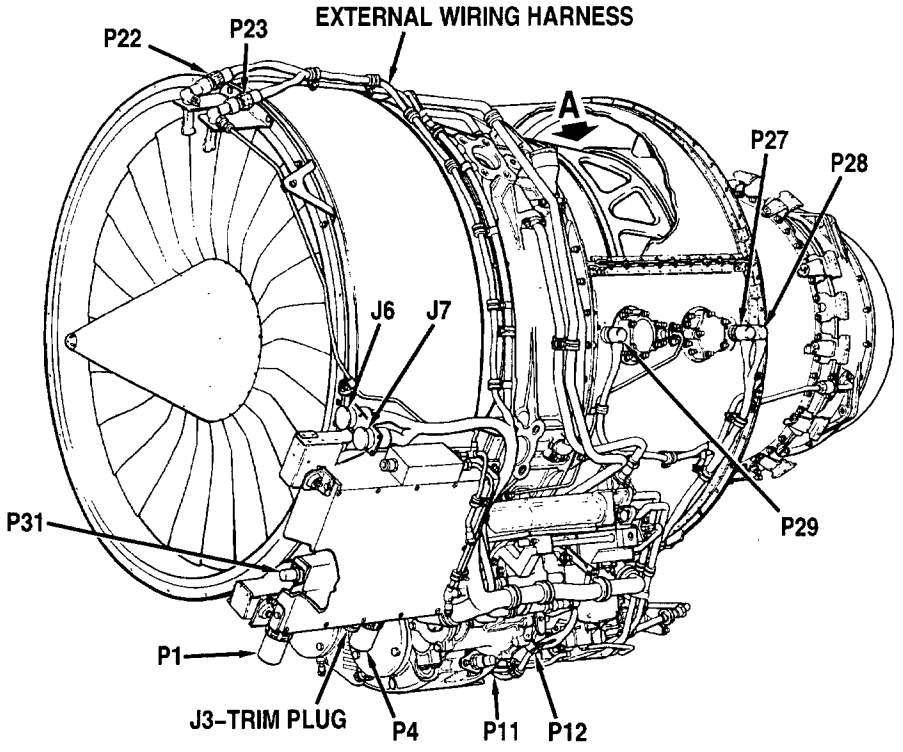
CONNECTOR	END DEVICE
P1	EEC - CH. A
P4	EEC - CH. B
P9	N2 Sensor - CH. A
P10	N2 Sensor - CH. B
P11	PMA - CH. A
P12	PMA - CH. B
P13	Compressor Bleed Valve Solenoid - CH. A
P14	Compressor Bleed Valve Solenoid - CH. B
P15	HMU - CH. A
P16	HMU - CH. B

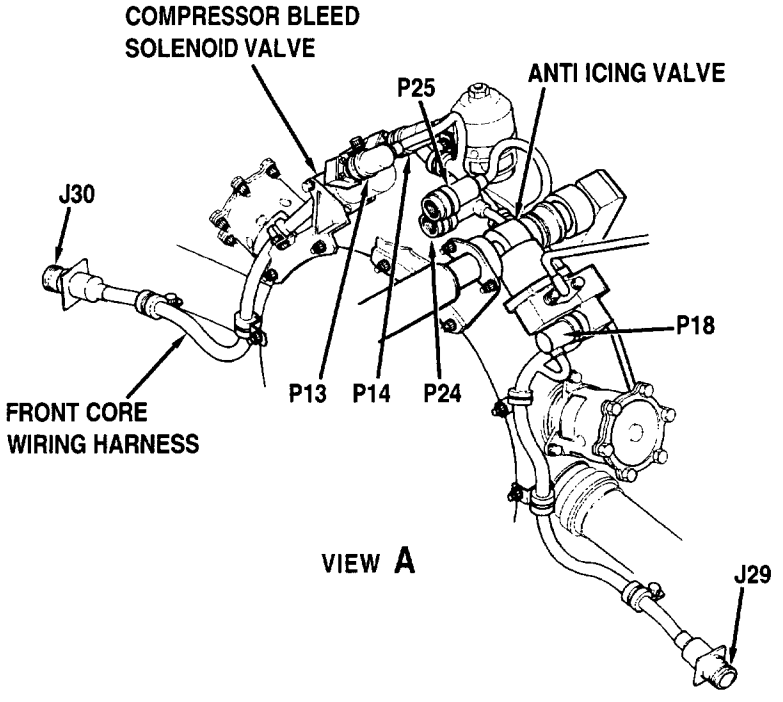
TABLE 1, "P" Connector Identification - Wiring Harness (Cont'd)

CONNECTOR	END DEVICE
P17	HMU - Standby Shutdown
P18	Anti-ice Solenoid Valve
P22	T1 Sensor - CH. B
P23	T1 Sensor - CH. A
P24	IGV Actuator - CH. B
P25	IGV Actuator - CH. A
P27	Rear Core Harness - CH. A
P28	Rear Core Harness - CH. B
P29	Front Core Harness - CH. A
P30	Front Core Harness - CH. B
P31	N1 Trim Plug
P34	Fuel Start and Dump Valve (PW305A or Post-SB24152)

TABLE 2, "J" Connector Identification - Wiring Harness

CONNECTOR	END DEVICE
J3	Trim Plug
J6	Airframe Connector - CH. B
J7	Airframe Connector - CH. A
J27	Rear Core Harness - CH. A
J28	Rear Core Harness - CH. B
J29	Front Core Harness - CH. A
J30	Front Core Harness - CH. B





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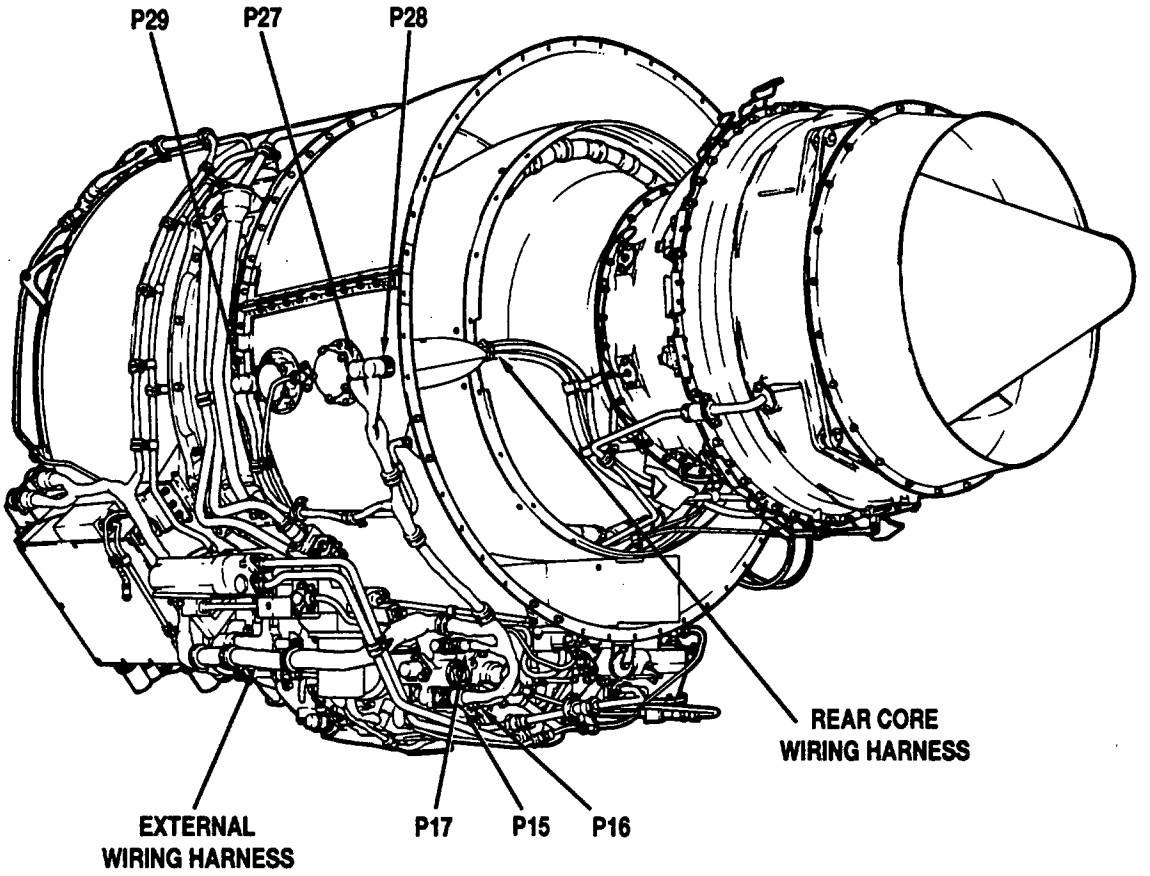
Engine Wiring Harnesses
Figure 14 (Sheet 1 of 3)



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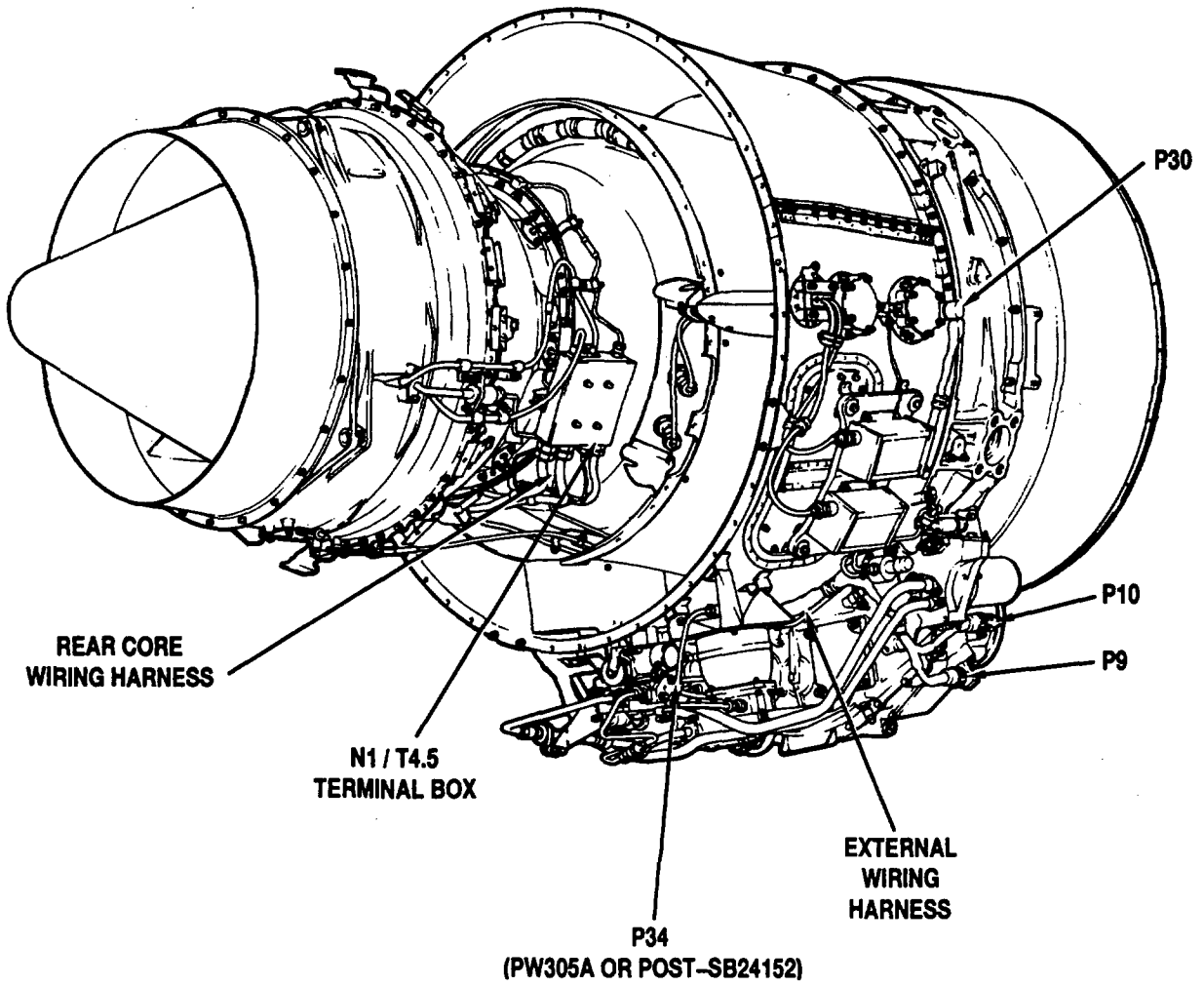
Engine Wiring Harnesses
Figure 14 (Sheet 2)



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Engine Wiring Harnesses
Figure 14 (Sheet 3)

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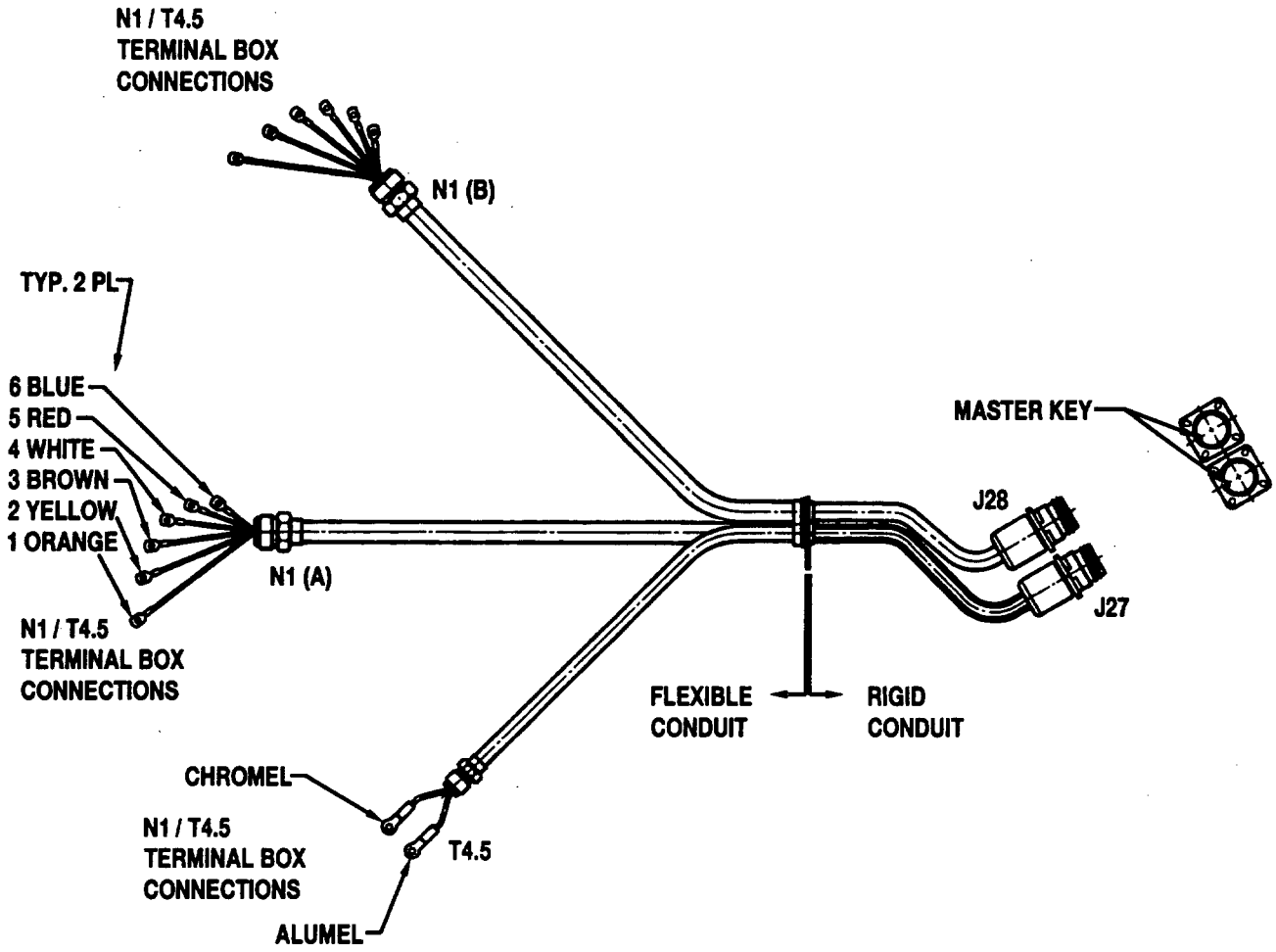
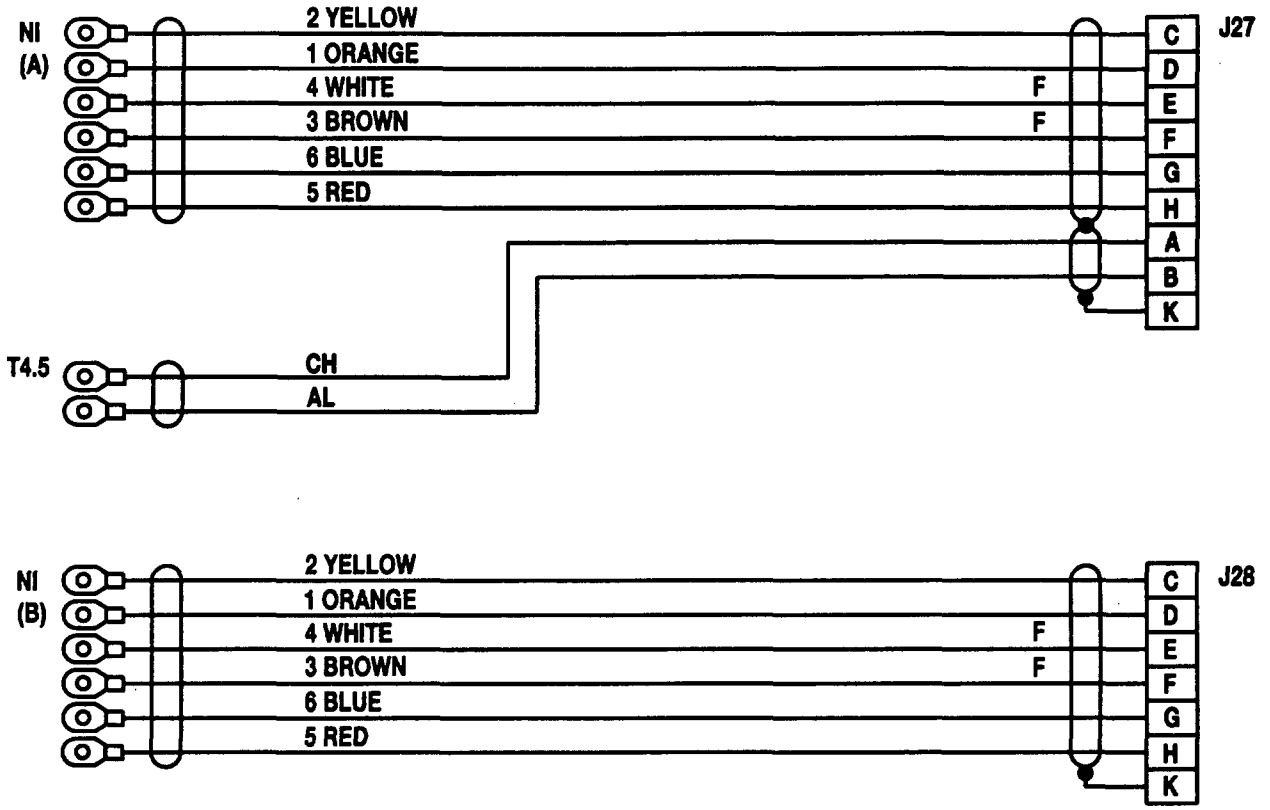


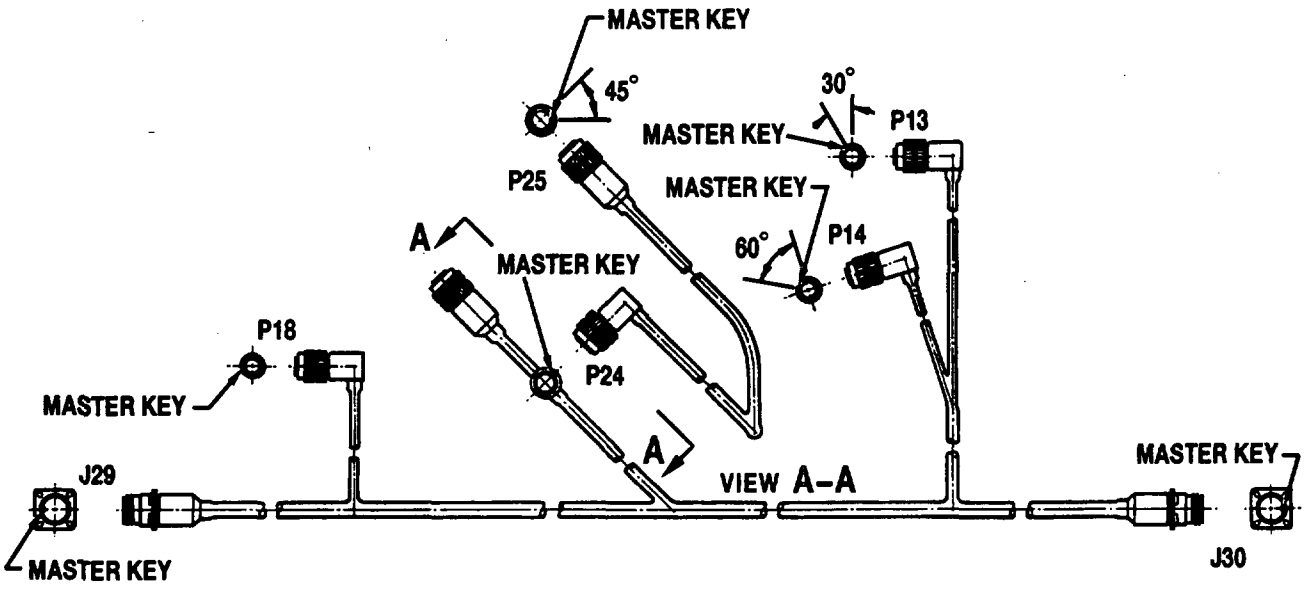
C42298

Rear Core Wiring Harness
Figure 15 (Sheet 1 of 2)



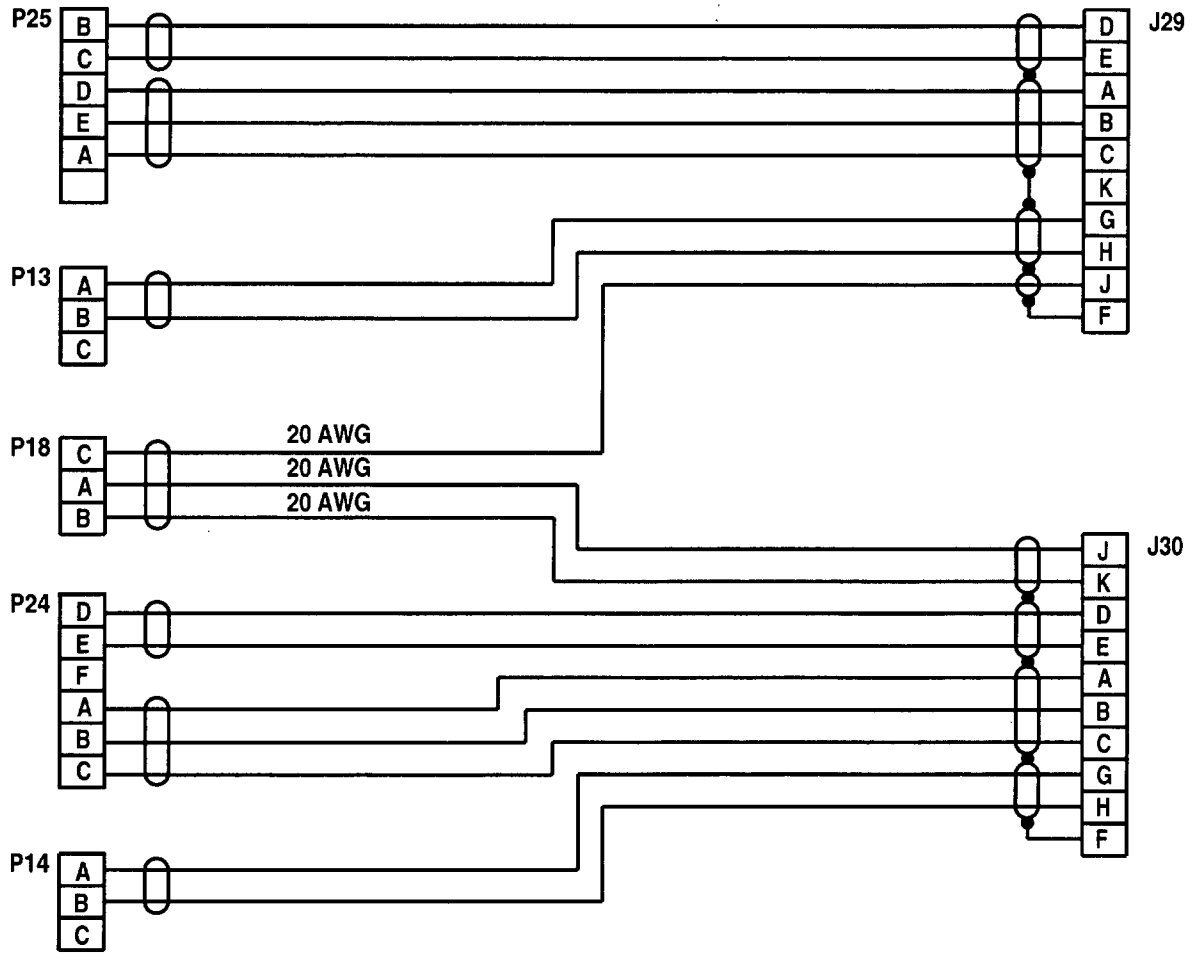
C42297

Rear Core Wiring Harness
Figure 15 (Sheet 2)



C42292

Front Core Wiring Harness
Figure 16 (Sheet 1 of 2)



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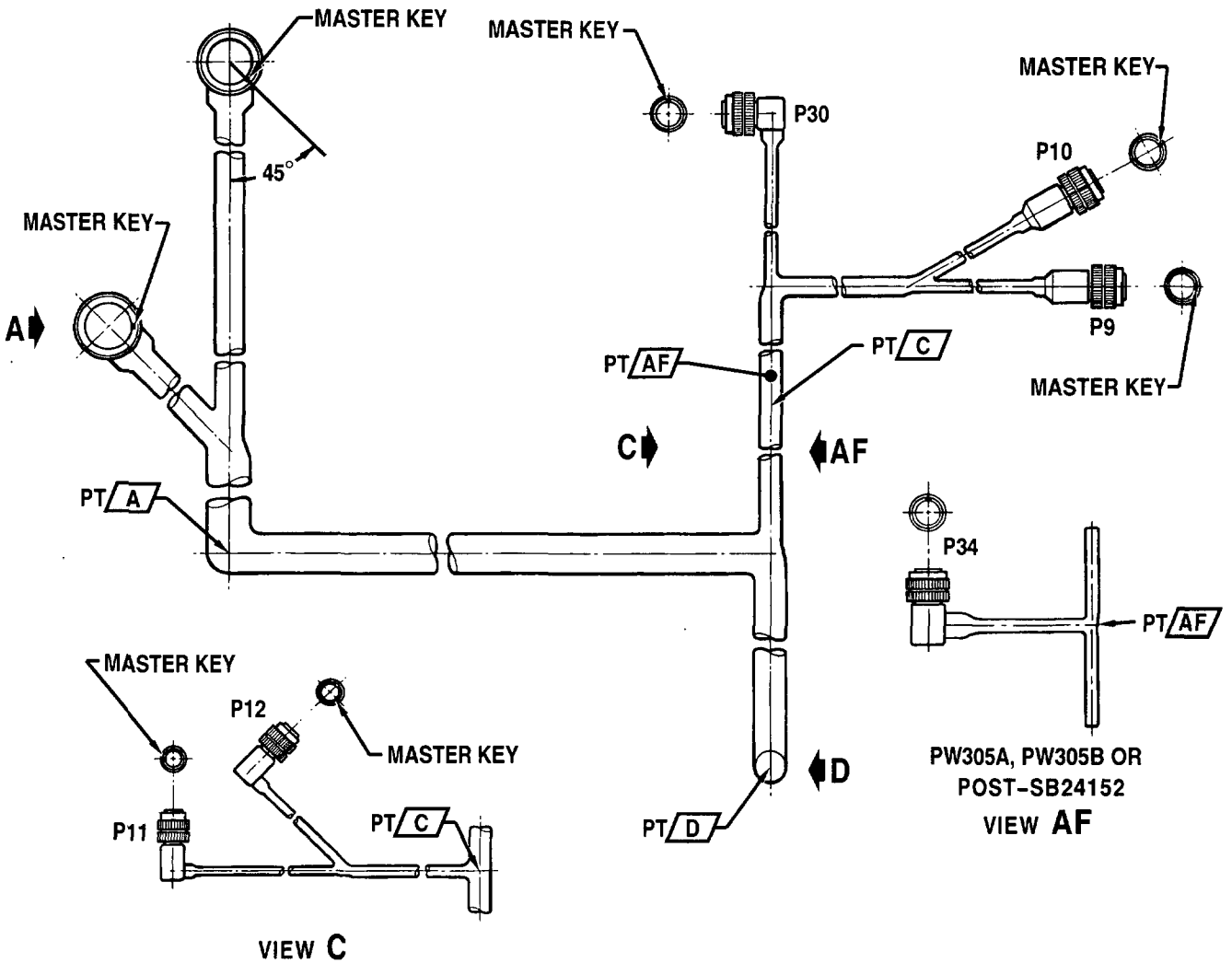
Front Core Wiring Harness
Figure 16 (Sheet 2)



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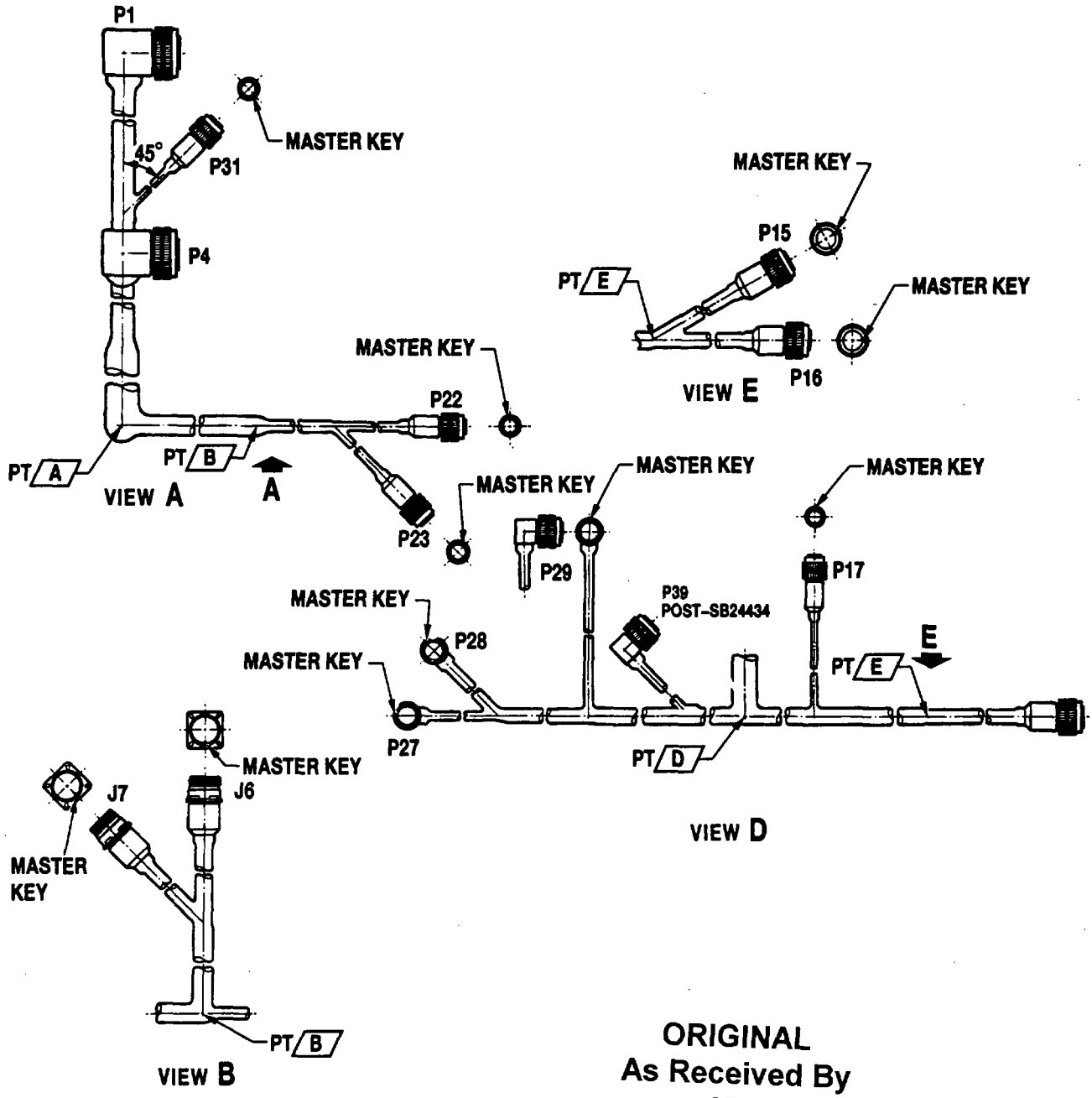
Outer Wiring Harness
Figure 17 (Sheet 1 of 5)



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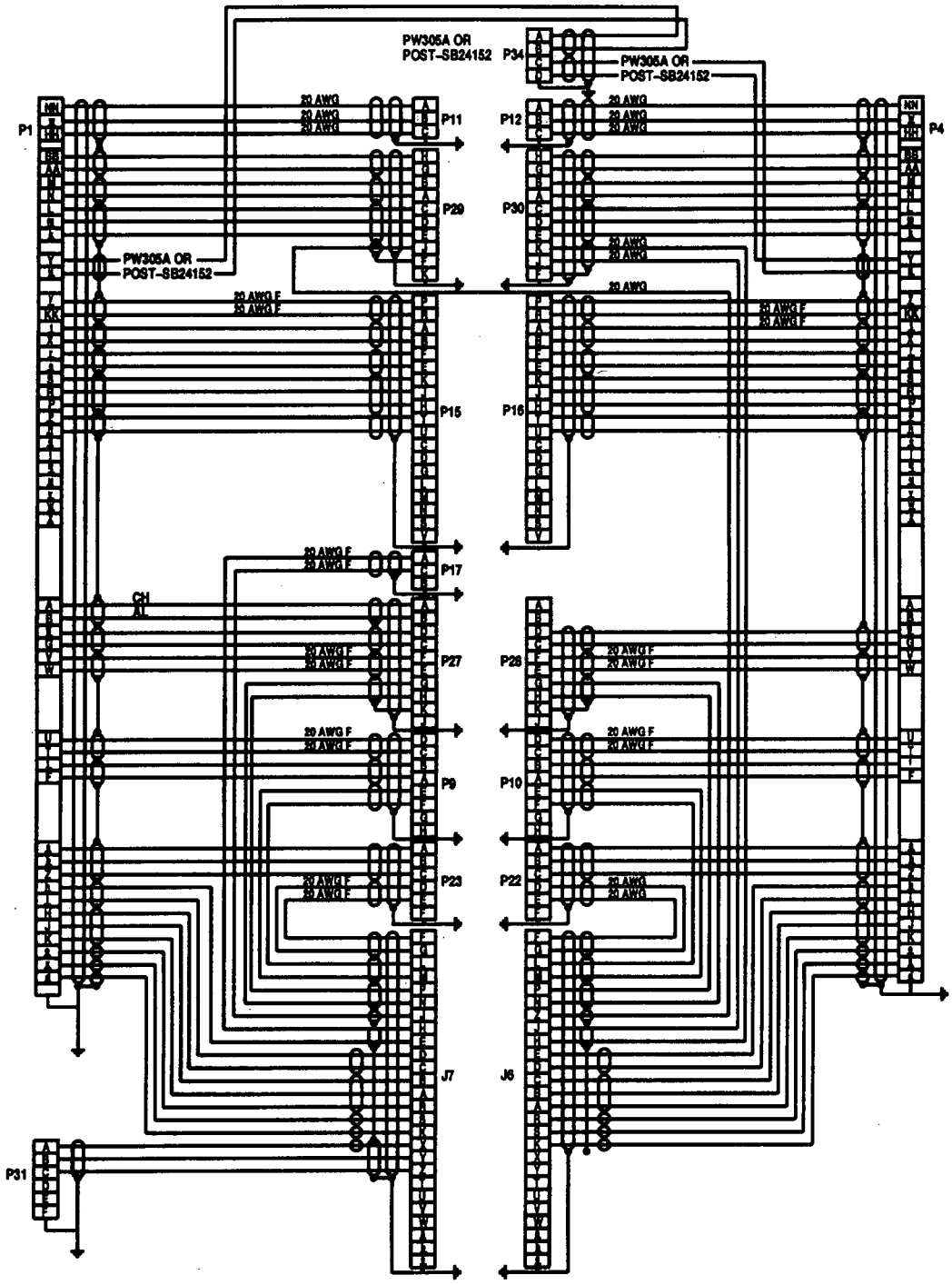
Outer Wiring Harness
Figure 17 (Sheet 2)



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Pre-SB24434

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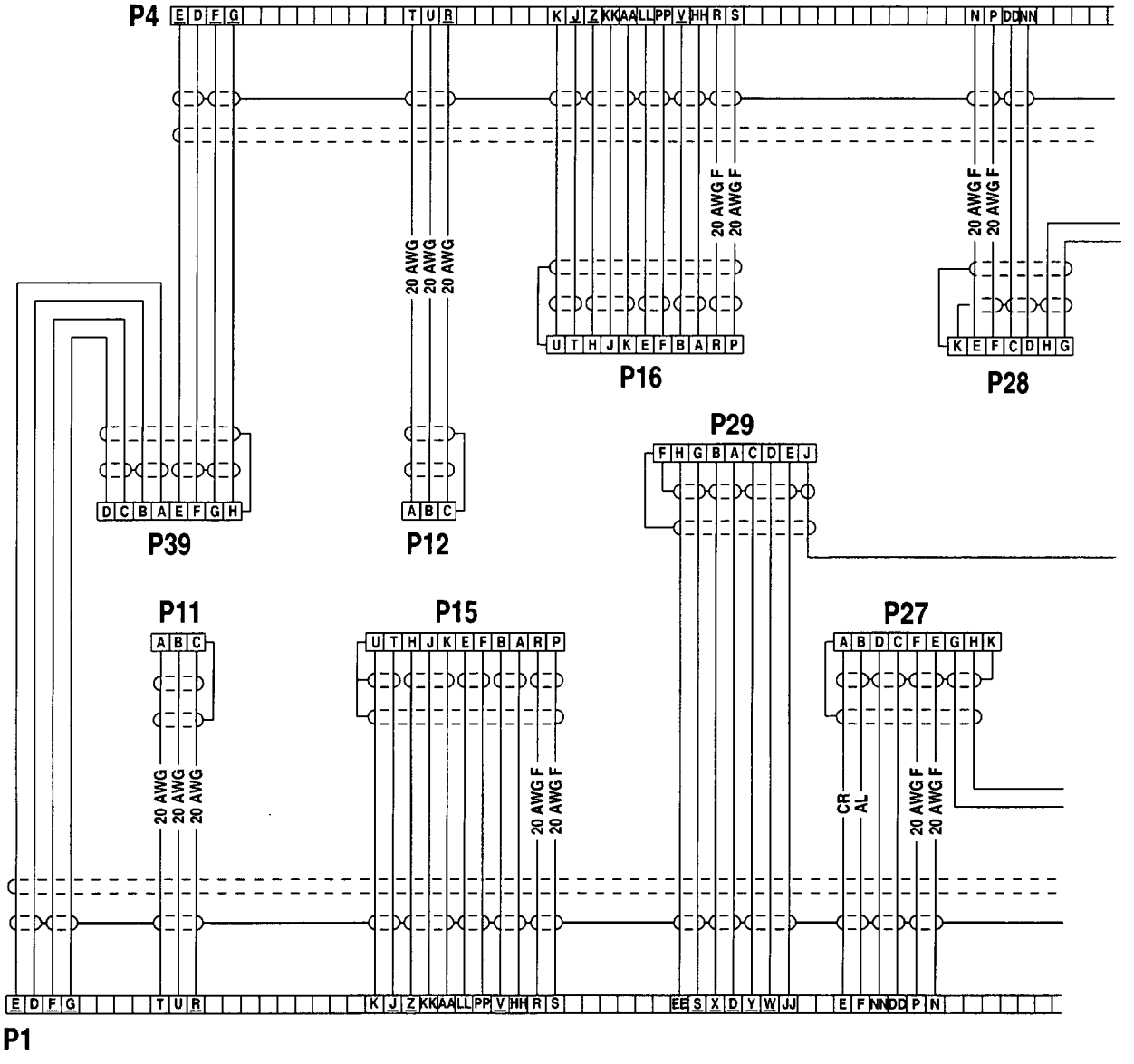
Outer Wiring Harness
Figure 17 (Sheet 3)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20 AWG F
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20 AWG F
U T H J K E F B A R P
P16
K E F C D H G
P28
P29
F H G B A C D E J
D C B A E F G H
P39
A B C
P12
P11
A B C
P15
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AL
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T U R
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P1

Post-SB24434 C62196A_1

Outer Wiring Harness
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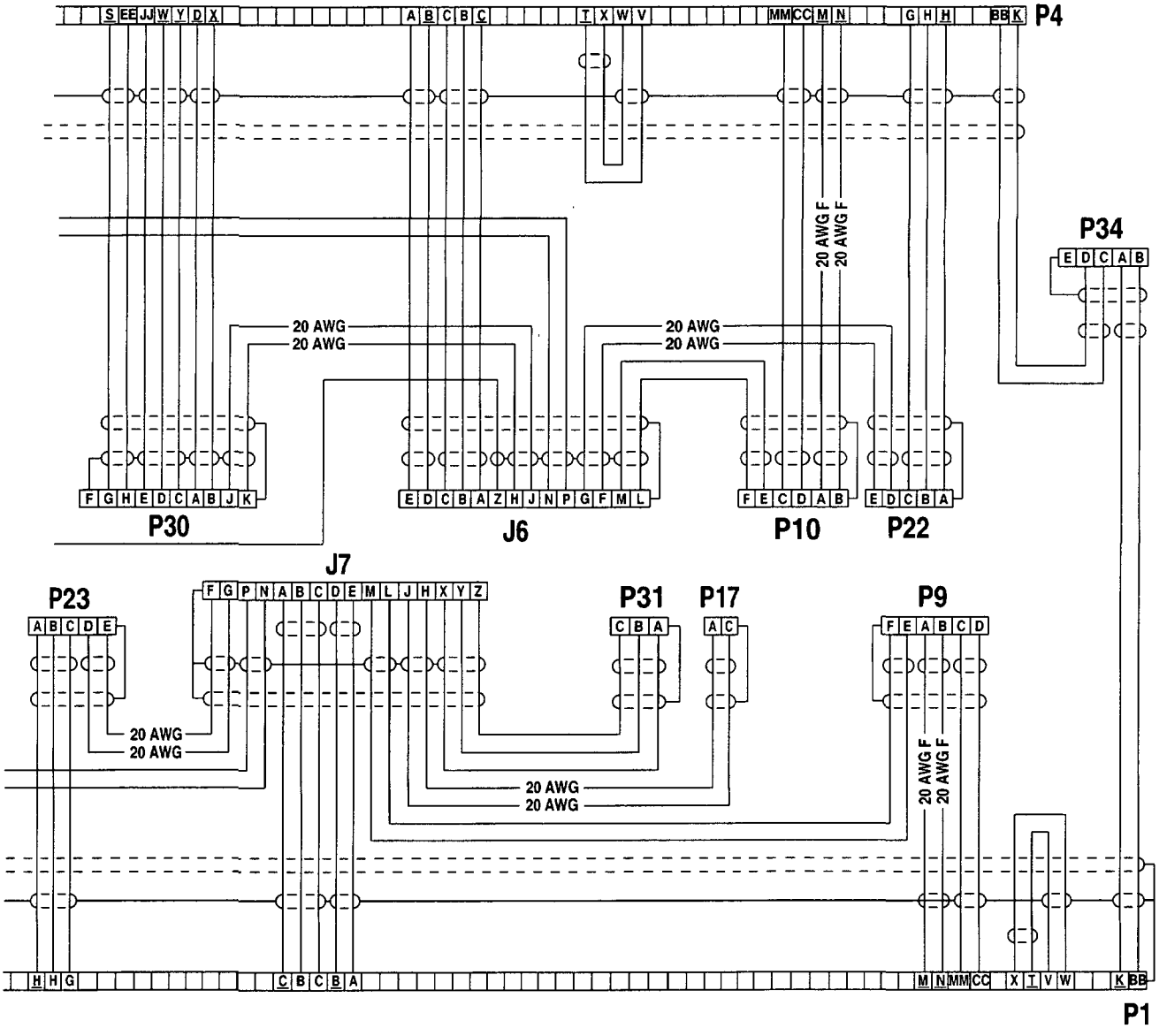

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Outer Wiring Harness
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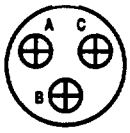

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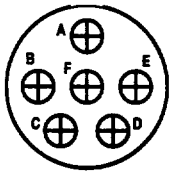

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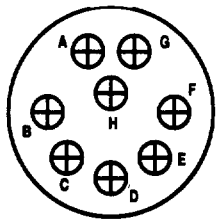
PW305A OR POST-SB24152



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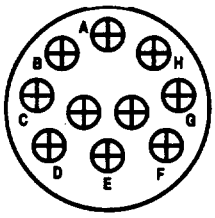

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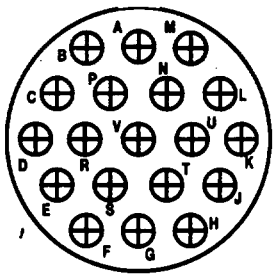

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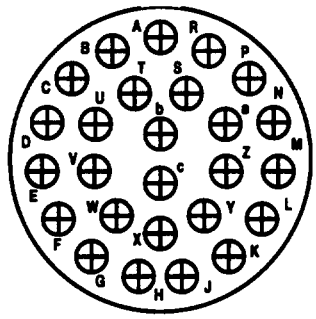
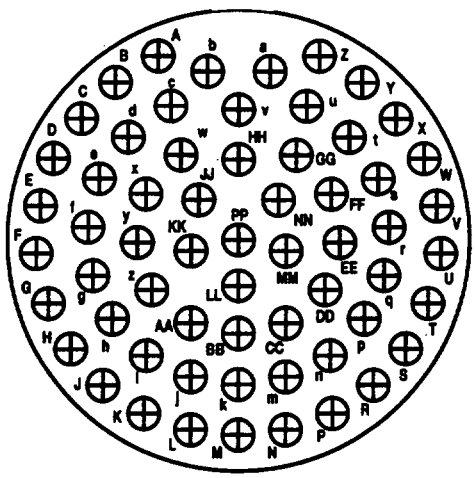


J6, J7



P1, P4

NOTES:

1. FRONT FACE OF SOCKET INSERTS SHOWN.
2. MASTER KEYWAY SHOWN AT TOP OF ILLUSTRATIONS; SECONDARY KEYWAYS NOT SHOWN.

C42299B

Outer Wiring Harness Connectors Pin/Socket Arrangements
Figure 18

TABLE OF CONTENTS

SUBJECT	PAGE
FUEL TUBES - MAINTENANCE PRACTICES	**73-10-01**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Primary and Secondary Fuel Delivery Tubes	201
A. Removal	201
B. Installation	204
6. Fuel Pressure Tubes to/from Fuel Waste Ejector	205
A. Removal	205
B. Installation	205
7. Fuel Pressure Tubes (HMU to/from Fuel Filter)	207
A. Removal	207
B. Installation	209
8. Fuel Bypass Tubes	210
A. Removal	210
B. Installation	210
9. IGV Fuel Tubes	215
A. Removal	215
B. Installation	215
10. Fits, Clearances and Torque Loadings	218
FUEL PUMP - MAINTENANCE PRACTICES	**73-10-02**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201

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TABLE OF CONTENTS

SUBJECT	PAGE
FUEL PUMP - MAINTENANCE PRACTICES (Cont'd)	**73-10-02**
5. Fuel Pump	201
A. Removal	201
B. Installation	203
6. Adjustment/Test	204
FUEL FILTER AND FUEL WASTE EJECTOR - MAINTENANCE PRACTICES	**73-10-03**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Fuel Filter Housing	201
A. Removal from Engine	201
B. Removal of Fuel Filter Element from Housing	203
C. Removal of Fuel Differential Pressure Switch and Filter Bypass Valve	203
D. Removal of Pre-SB24042 Fuel Temperature Sensor Adapter	203
E. Removal of Fuel Filter Drain Adapter	203
F. Removal of Air Bleed Adapter	203
G. Verify Seating of Bypass Valve	206
H. Assembly of Fuel Filter Bypass Valve	206
I. Assembly of Fuel Filter Housing	207
J. Installation on Engine	207
6. Fuel Filter	208
A. Removal from Engine	208
B. Installation on Engine	208

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TABLE OF CONTENTS

SUBJECT	PAGE
FUEL FILTER AND FUEL WASTE EJECTOR - MAINTENANCE PRACTICES (Cont'd)	**73-10-03**
7. Fuel Waste Ejector	208
A. Removal	208
B. Installation	209
8. Cleaning	209
A. Fuel Filter Housing, Filter Cover and Bypass Valve	209
9. Inspection/Check	209
A. Fuel Filter	209
FUEL MANIFOLD - MAINTENANCE PRACTICES	**73-10-04**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Primary Fuel Tube Assembly	202
A. Removal	202
B. Installation	202
6. Primary Fuel Manifold and Nozzles	203
A. Removal	203
B. Installation	205
7. Secondary Fuel Manifold and Nozzles	210
A. Removal	210
B. Installation	211
8. Cleaning/Painting	214
A. Cleaning of Fuel Nozzles	214

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
FUEL MANIFOLD - MAINTENANCE PRACTICES (Cont'd)	**73-10-04**
9. Inspection/Check	214
A. Inlet Fuel Nozzle	214
B. Primary Fuel Nozzles	214
C. Secondary Fuel Nozzles	214
10. Adjustment/Test	214
A. Fuel Manifold Assembly Pressure Test	214
B. Fuel Manifold Pressure Test - Combustor Installed on Engine	215
FUEL SHUTOFF AND DRAIN - MAINTENANCE PRACTICES	**73-10-05**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Fuel Dump Valve (Pre-SB24156) or Start Fuel and Dump Valve (PW305A or Post-SB24156)	201
A. Removal	201
B. Installation	203
C. Functional Check	204
6. Fuel shut-off Valve	205
A. Removal	205
B. Installation	205
C. Resetting Procedure	205
D. Visual Inspection	207
E. Periodic Inspection	208
7. Emergency Fuel Shut-off Cable	208
A. Removal	208

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
FUEL SHUTOFF AND DRAIN - MAINTENANCE PRACTICES (Cont'd)	**73-10-05**
B. Installation	212
C. Adjustment (Rigging)	212
8. Fuel Drain Valve Adapter	215
A. Disassembly	215
B. Assembly	215

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Sep 12/2008
	2	Sep 12/2008
Contents	1	Sep 12/2008
	2	Sep 12/2008
	3	Sep 12/2008
	4	Sep 12/2008
	5	Sep 12/2008
	6 blank	Sep 12/2008
73-10-01 Maintenance Practices	201	Sep 12/2008
	202	Sep 12/2008
	203	Sep 12/2008
	204	Sep 12/2008
	205	Sep 12/2008
	206	Sep 12/2008
	207	Sep 12/2008
	208	Sep 12/2008
	209	Sep 12/2008
	210	Sep 12/2008
	211	Sep 12/2008
	212	Sep 12/2008
	213	Sep 12/2008
	214	Sep 12/2008
	215	Sep 12/2008
	216	Sep 12/2008
	217	Sep 12/2008
	218	Sep 12/2008
	219	Sep 12/2008
	220	Sep 12/2008
73-10-02 Maintenance Practices	201	Nov 09/2007
	202	Nov 09/2007
	203	Nov 09/2007
	204	Nov 09/2007
73-10-03 Maintenance Practices	201	Sep 06/2002
	202	Mar 02/2001
	203	Mar 02/2001
	204	Mar 02/2001
	205	Mar 02/2001
	206	Sep 06/2002
	207	Mar 02/2001
	208	Sep 06/2002
	209	Mar 02/2001
	210	Mar 02/2001
	211	Mar 02/2001
	212	Mar 02/2001
	213	Mar 02/2001
	214 blank	Mar 02/2001
73-10-04 Maintenance Practices	201	Feb 15/2008
	202	Feb 15/2008
	203	Feb 15/2008
	204	Feb 15/2008
	205	Feb 15/2008
	206	Feb 15/2008
	207	Feb 15/2008
	208	Feb 15/2008
	209	Feb 15/2008
	210	Feb 15/2008
	211	Feb 15/2008
	212	Feb 15/2008
	213	Feb 15/2008
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	215	Feb 15/2008
	216	Feb 15/2008
	217	Feb 15/2008
	218	Feb 15/2008
	219	Feb 15/2008
	220 blank	Feb 15/2008
73-10-05 Maintenance Practices	201	Nov 09/2007
	202	Nov 09/2007
	203	Nov 09/2007
	204	Nov 09/2007
	205	Nov 09/2007
	206	Nov 09/2007
	207	Nov 09/2007
	208	Nov 09/2007
	209	Nov 09/2007
	210	Nov 09/2007

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
	211	Nov 09/2007
	212	Nov 09/2007
	213	Nov 09/2007
	214	Nov 09/2007
	215	Nov 09/2007
	216	Nov 09/2007
	217	Nov 09/2007
	218	Nov 09/2007

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FUEL TUBES - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-089	Lockwire

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name	Application
PWC34520	DELETED	Replaced by PWC50781 or PWC50782
PWC50781	Puller	Alternatively use Puller PWC50782
PWC50782	Puller	Alternatively use Puller PWC34520

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Primary and Secondary Fuel Delivery Tubes

   A. Removal (Ref. Fig. 201)

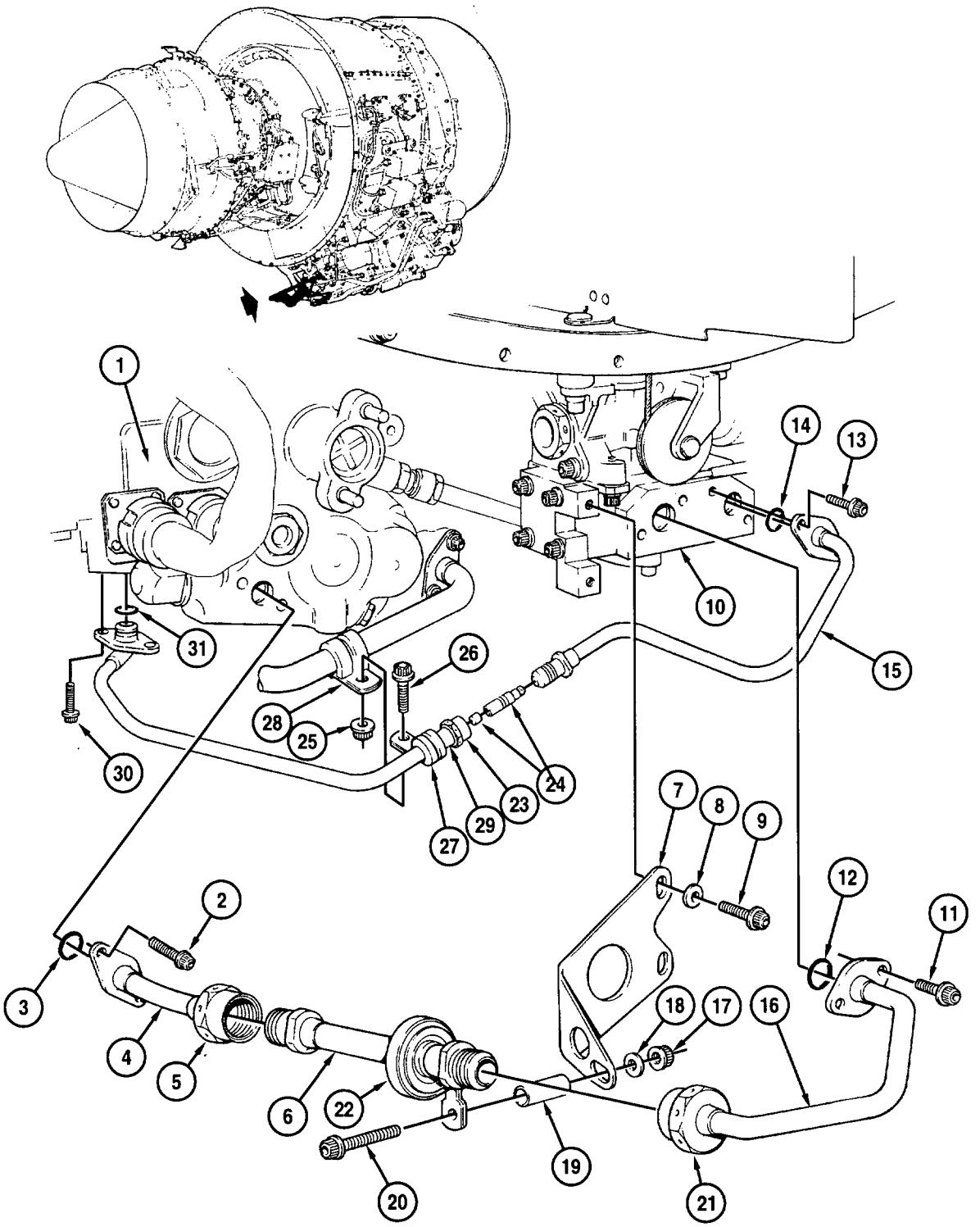
      (1) Remove lockwire and loosen coupling nut (21).

      (2) Removed two bolts (11) and remove fuel tube (16). Discard preformed packing (12).

      (3) Remove lockwire and loosen coupling nut (5).

      (4) Remove nut (17), washer (18), spacer (19) and bolt (20).

      (5) Remove fuel tube (6) and loop clamp (22).



C19742A

Primary and Secondary Fuel Delivery Tubes - Removal/Installation
Figure 201

Key to Figure 201

1. HMU (Ref.)
2. Bolt
3. Preformed Packing
4. Fuel Tube (Secondary supply)
5. Coupling Nut
6. Fuel Tube (Secondary supply)
7. Flowmeter Mounting Bracket
8. Washer
9. Bolt
10. Dump Valve (Ref.)
11. Bolt
12. Preformed Packing
13. Bolt
14. Preformed Packing
15. Fuel Tube (Primary supply)
16. Fuel Tube (Secondary supply)
17. Self-locking Nut
18. Washer
19. Spacer
20. Bolt
21. Coupling Nut
22. Loop Clamp
23. Coupling Nut
24. Restrictor and Expansion Plug
25. Self-locking Nut
26. Bolt
27. Loop Clamp
28. Loop Clamp
29. Fuel Tube (Primary supply)
30. Bolt
31. Preformed Packing

(6) Remove two bolts (9), washers (8) and remove bracket (7).

(7) Remove two bolts (2) and remove fuel tube (4). Discard preformed packing (3).

(8) Remove lockwire and loosen coupling nut (23). Remove two bolts (13) and remove fuel tube (15). Discard preformed packing (14).

(9) Remove restrictor and expansion plug (24) from fuel tube (15) with puller (PWC50781) or (PWC50782).

(10) Remove nut (25), bolt (26) and loop clamp (28).

(11) Remove two bolts (30) and fuel tube (29). Discard preformed packing (31).

B. Installation (Ref. Fig. 201)

(1) Lubricate new preformed packing (3) with engine oil (PWC03-001) and install on fuel tube (4). Secure fuel tube to HMU with two bolts (2). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(2) Position fuel tube (6) on fuel tube (4) and secure with coupling nut (5), fingertight.

(3) Loosely assemble bracket (7) to dump valve (10) with two bolts (9) and washers (8).

(4) Loosely assemble loop clamp (22) to fuel tube (6) and bracket (7) with bolt (20), spacer (19), washer (18) and nut (17).

(5) Lubricate new preformed packing (12) with engine oil (PWC03-001) and install on fuel tube (16). Install fuel tube on dump valve (10) and fuel tube (6). Tighten coupling nut (21) fingertight.

(6) Secure fuel tube (16) to dump valve (10) with two bolts (11). Torque 36 to 40 lb.in. (3.1-3.4 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(7) Torque bolts (9) 36 to 40 lb.in. (4.1-4.5 Nm). Torque nut (17) 27 to 30 lb.in. (3.1-3.4 Nm).

(8) Hold flats of fuel tubes (4 and 6) and torque coupling nuts (5 and 21) 475 to 525 lb.in. (53.6 - 59.3 Nm) and lockwire (PWC05-089).

NOTE: Use only heavy duty 6 - point crowfoot to torque coupling nut.

(9) Secured fuel tube (15) in soft jawed vise and insert fuel pressure restrictor (24). Secure with expansion plug. Drive plug into tube, flush with end of tube to within 0.005 inch (Table 204, REF. NO. 3803).

(10) Lubricate new preformed packing (14) with engine oil (PWC03-001) and install on fuel tube (15). Install fuel tube on dump valve with two bolts (13). Torque 36 to 40 lb.in. (4.1-4.5 Nm) .

(11) Lubricate new preformed packing (31) with engine oil (PWC03-001) and install on fuel tube (29). Install fuel tube on HMU with two bolts (30). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(12) Assemble fuel tube (29) to fuel tube (15) loosely, with coupling nut (23).

CAUTION: DO NOT LUBRICATE THREADS.

(13) Assemble loop clamps (27 and 28) to fuel tubes with bolt (26) and nut (25). Torque 27 to 30 lb.in. (3.1-3.4 Nm).

(14) Hold flats of fuel tube and torque coupling nut (23) 90 to 100 lb.in. (10.2-11.3 Nm) and lockwire (PWC05-089).

6. Fuel Pressure Tubes to/from Fuel Waste Ejector

A. Removal (Ref. Fig. 202)

(1) Remove nut (13), bolt (15), two loop clamps (16) and spacer (14).

(2) Remove lockwire and loosen coupling nut (21).

(3) Remove two bolts (12) and remove fuel tube (20). Discard preformed packing (11).

(4) Remove lockwire, loosen coupling nuts (9 and 18) and remove fuel tube (17).

(5) Remove lockwire and loosen coupling nuts (6 and 8).

(6) Remove fuel tube (7) (Pre-SB24156) or (23) (Post-SB24156 or PW305A) and withdraw strainer element (5).

B. Installation (Ref. Fig. 202)

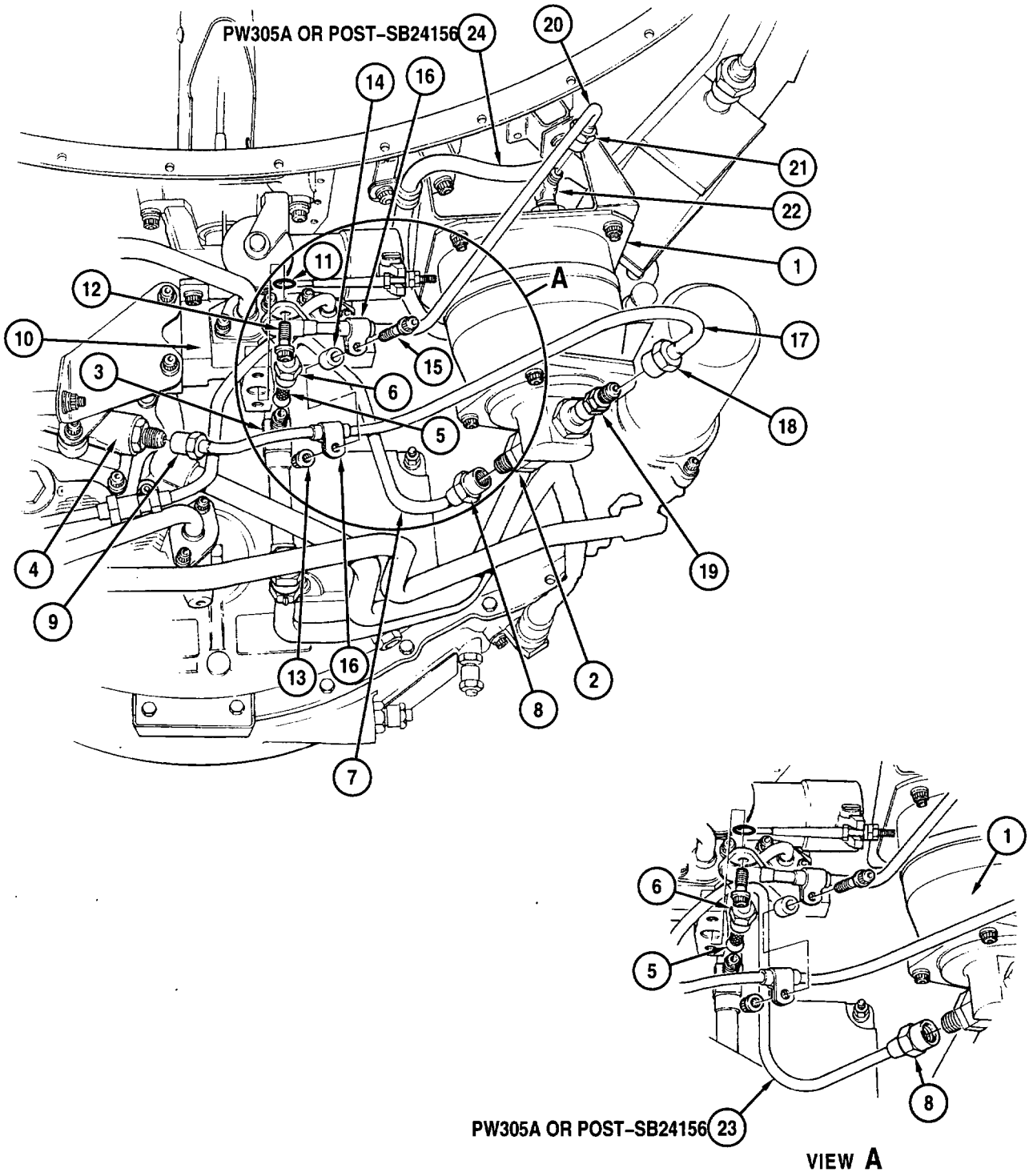
(1) Install strainer element (5) into fuel tube (7 or 23) and position fuel tube (7) (Pre-SB24156) or (23) (Post-SB24156 or PW305A) on fuel tube tee (3). Move coupling nut (6) back, to ensure cone of strainer is sandwiched between tube and nipple. Tighten coupling nuts (6 and 8) and torque 135 to 150 lb.in. (15.3-17.0 Nm) and lockwire (PWC05-089).

(2) Install fuel tube (17). Torque coupling nuts (9 and 18) 90 to 100 lb.in. (10.2-11.3 Nm) and lockwire (PWC05-089).

(3) Lubricate new performed packing (11) with engine oil (PWC03-001) and install on fuel tube (20).

(4) Install fuel tube (20) on HMU with two bolts (12). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(5) If necessary, align elbow (22) with fuel tube (20). Hold elbow and torque coupling nut (21) 90 to 100 lb.in. (10.2-11.3 Nm). Torque coupling nut securing elbow (22) to ejector tank 38 to 42 lb.in. (4.3-4.8 Nm) and lockwire (PWC05-089) both coupling nuts .



C19003A

Fuel Pressure Tubes (to/from Fuel Waste Ejector) - Removal/Installation
Figure 202

Key to Figure 202

1. Fuel Waste Ejector (Ref.)
2. Ejector Inlet
3. Fuel Pressure Tube (Tee)
4. Fuel Pump (Ref.)
5. Strainer Element
6. Coupling Nut
7. Ejector to Tee Fuel Tube (Pre-SB24156)
8. Coupling Nut
9. Coupling Nut
10. Fuel Dump Valve (Ref.)
11. Preformed Packing
12. Bolt
13. Self-locking Nut
14. Spacer
15. Bolt
16. Loop Clamp
17. Ejector to Pump Fuel Tube
18. Coupling Nut
19. Ejector Outlet
20. Fuel Tube Assembly
21. Coupling Nut
22. Elbow
23. Ejector to Tee Fuel Tube (PW305A or Post-SB24156)
24. P34 (Wiring Harness) (PW305A or Post-SB24152)

CAUTION: DO NOT LUBRICATE THREADS.

(6) Install two loop clamps (16) with spacer (14), nut (13) and bolt (15). Torque 27 to 30 lb.in. (3.1-3.4 Nm).

7. Fuel Pressure Tubes (HMU to/from Fuel Filter)

A. Removal (Ref. Fig. 203)

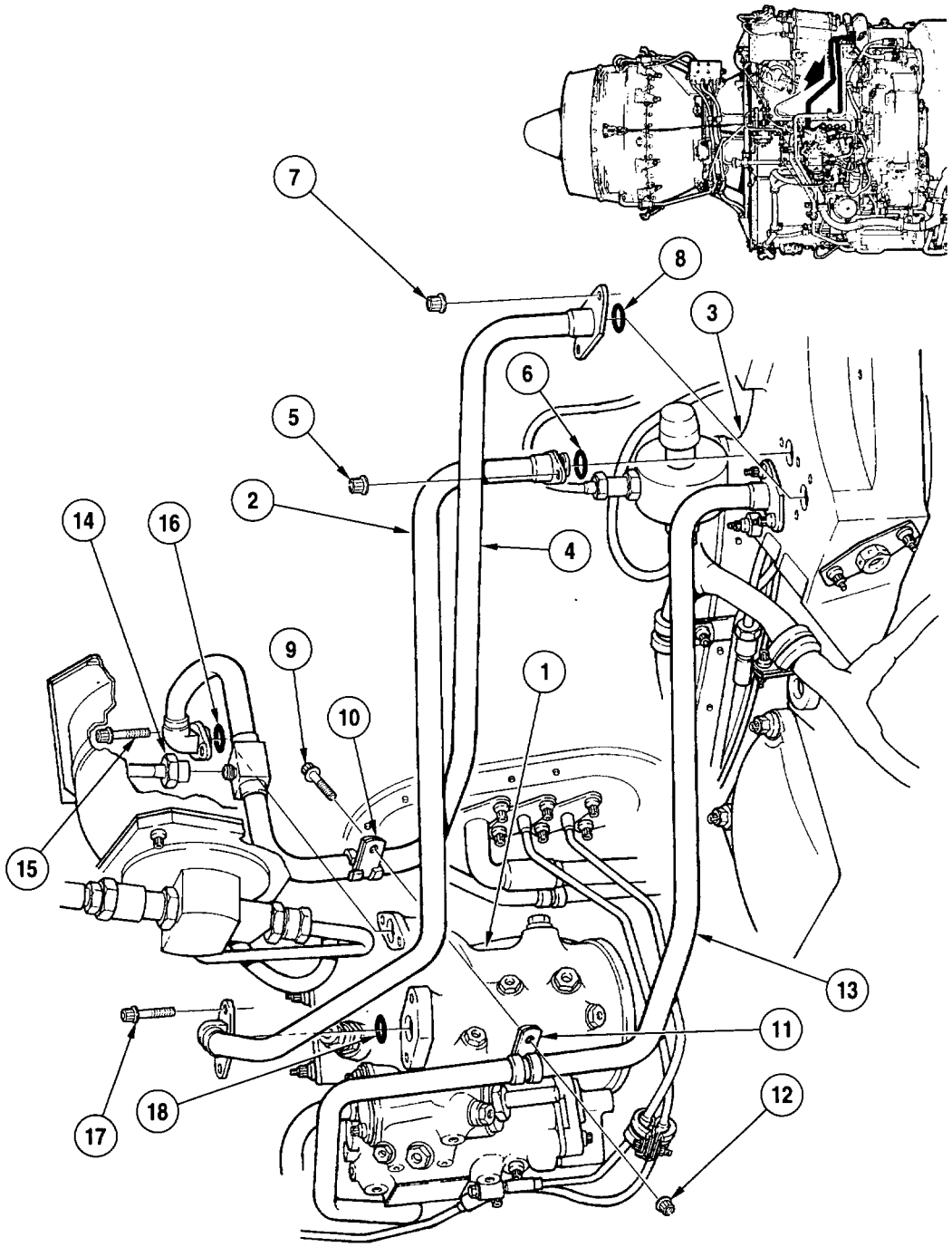
(1) Remove two nuts (5) and bolts (17).

(2) Remove fuel pressure tube (2) from engine and discard preformed packings (6 and 18).

(3) Remove nut (12), bolt (9) and loop clamp (10).

(4) Remove lockwire and loosen coupling nut (14).

(5) Remove two nuts (7) and bolts (15).



C19735

Fuel Pressure Tubes (HMU to/from Fuel Filter) - Removal/Installation
Figure 203

Key to Figure 203

1. HMU (Ref.)
2. Fuel Pressure Tube (Filter to HMU)
3. Fuel Filter Housing (Ref.)
4. Fuel Pressure Tube (HMU to Filter)
5. Self-locking Nut
6. Preformed Packing
7. Self-locking Nut
8. Preformed Packing
9. Bolt
10. Loop Clamp
11. Loop Clamp
12. Self-locking Nut
13. Fuel Bypass Tube (Ref.)
14. Coupling Nut
15. Bolt
16. Preformed Packing
17. Bolt
18. Preformed Packing

CAUTION: DIRT MUST NOT ENTER THE FUEL SYSTEM. TAKE ALL NECESSARY PRECAUTIONS TO AVOID INGRESS OF FOREIGN MATERIAL. WHEREVER POSSIBLE, INSTALL PROTECTIVE CAPS OR PLUGS ON ALL EXPOSED OPENINGS BEFORE REMOVING THE FUEL TUBES.

(6) Remove fuel pressure tube (4) from engine and discard preformed packings (8 and 16).

B. Installation (Ref. Figs. 202 and 203)

(1) Lubricate new preformed packings (8 and 16, Fig. 203) with engine oil (PWC03-001) and install on fuel pressure tube (4).

(2) Install fuel tube (4) on HMU and fuel filter housing with two bolts (15) and two nuts (7). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm). Torque nuts 27 to 30 lb.in. (3.1-3.4 Nm).

(3) Position coupling nut (14) on tee of fuel tube (4). Ensure cone of strainer element is properly positioned in fuel tube (Ref. Fig. 202). Torque coupling nut 135 to 150 lb.in. (15.3-17.0 Nm) and lockwire (PWC05-089).

CAUTION: DO NOT LUBRICATE THREADS.

(4) Install loop clamp (10, Fig. 203) with bolt (9) and nut (12). Torque 27 to 30 lb.in. (3.1-3.4 Nm).

(5) Lubricate new preformed packings (6 and 18) with engine oil (PWC03-001) and install on fuel tube (2).

CAUTION: DO NOT LUBRICATE NUTS.

(6) Install fuel tube (2) with two bolts (17) and two nuts (5). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm). Torque nuts 27 to 30 lb.in. (3.1-3.4 Nm).

8. Fuel Bypass Tubes

A. Removal (Ref. Fig. 204)

(1) Post-SB24014: Remove the two nuts (30) and heat shield (31).

(2) Remove nut (13), bolt (11) and loop clamp (12).

(3) Remove nut (18), bolt (15) and loop clamp (14).

(4) Pre-SB24555: Remove two bolts (5) and two bolts (20).

(5) Post-SB24555: Remove two bolts (29), two washers (28) and two bolts (20).

(6) Remove fuel bypass tube (2) from engine and discard preformed packings (6 and 19).

(7) Remove nut (7), bolt (9) and loop clamp (8).

(8) Remove nut (24), bolt (22) and loop clamps (21).

(9) Pre-SB24555: Remove two bolts (3), bracket (27) and two nuts (26).

(10) Post-SB24555: Remove two bolts (29), washer (28), bracket (27) and two nuts (26).

CAUTION: DIRT MUST NOT ENTER THE FUEL SYSTEM. TAKE ALL NECESSARY PRECAUTIONS TO AVOID INGRESS OF FOREIGN MATERIAL. WHEREVER POSSIBLE, INSTALL PROTECTIVE CAPS OR PLUGS ON ALL EXPOSED OPENINGS BEFORE REMOVING THE FUEL TUBES.

(11) Remove fuel bypass tube (1) from engine and discard preformed packings (4 and 25).

B. Installation (Ref. Fig. 204)

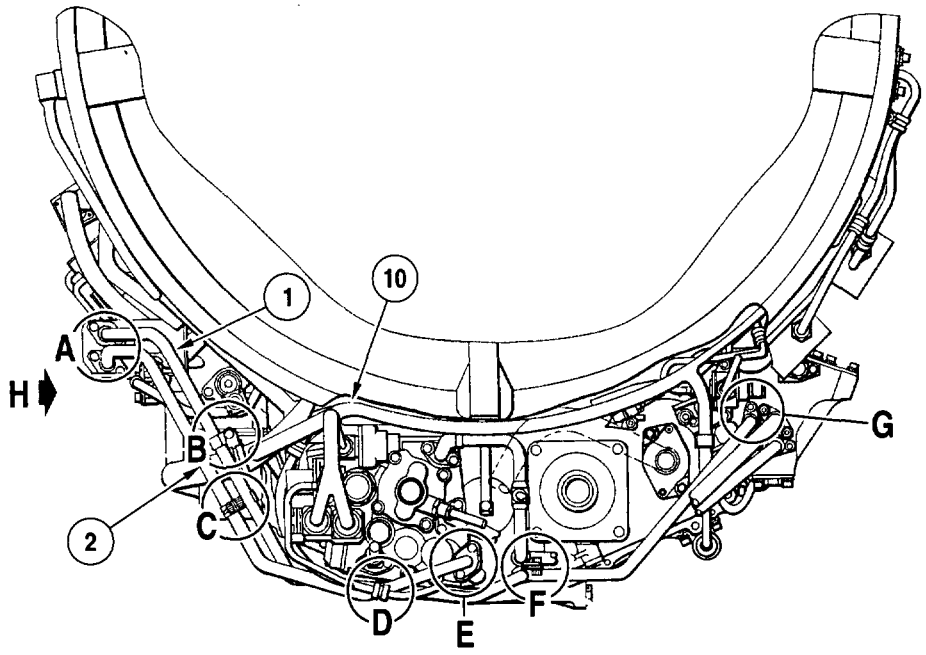
(1) Lubricate new preformed packings (4 and 25) and install on fuel bypass tube (1).

CAUTION: DO NOT LUBRICATE NUTS.

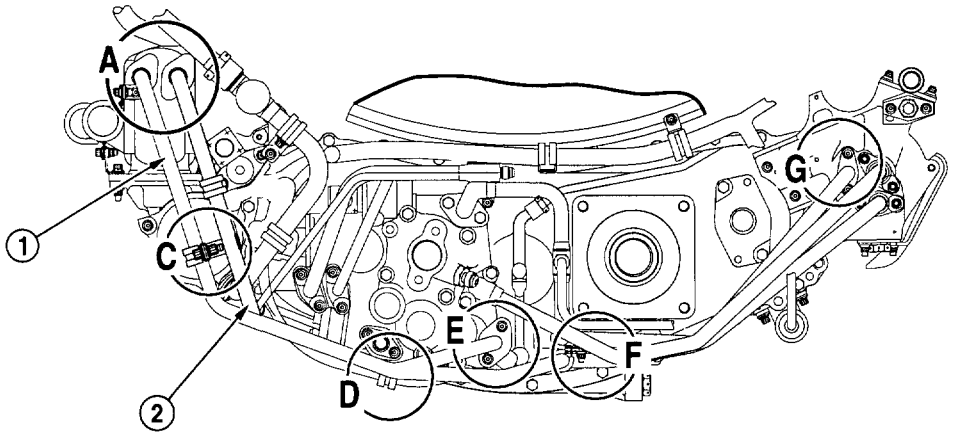
(2) Pre-SB24555: Install fuel bypass tube (1) with two bolts (3), bracket (27) and two nuts (26). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm). Torque nuts 27 to 30 lb.in. (3.0-3.4 Nm).

(3) Post-SB24555: Install fuel bypass tube (1) with two bolts (29), washer (28), bracket (27) and two nuts (26). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm). Torque nuts 27 to 30 lb.in. (3.0-3.4 Nm).

(4) Install loop clamp (8) with bolt (9) and nut (7). Torque 36 to 40 lb.in. (4.0-4.6 Nm).



PRE-SB24367



POST-SB24367

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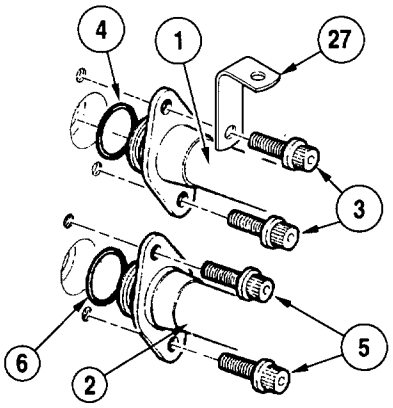
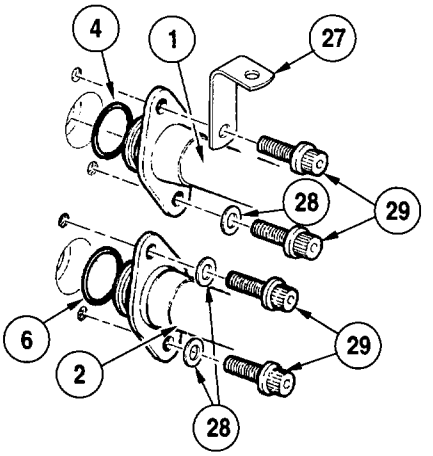
Fuel Bypass Tubes - Removal/Installation
Figure 204 (Sheet 1 of 3)

Key to Figure 204

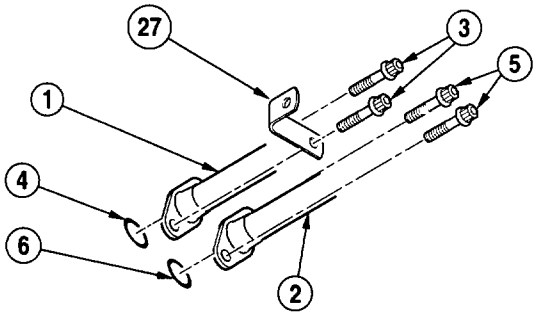
1. Fuel Bypass Tube (Heater to Filter)
2. Fuel Bypass Tube (HMU to Heater)
3. Bolt
4. Preformed Packing
5. Bolt
6. Preformed Packing
7. Self-locking Nuts
8. Loop Clamp
9. Bolt
10. External Wiring Harness (Ref.)
11. Bolt
12. Loop Clamp
13. Self-locking Nut
14. Loop Clamp
15. Bolt
16. Primary Fuel Tube (Ref.)
17. Loop Clamp
18. Self-locking Nut
19. Preformed Packing
20. Bolt
21. Loop Clamp
22. Bolt
23. Fuel Pressure Tube (Ref.)
24. Self-locking Nut
25. Preformed Packing
26. Self-locking Nut
27. Bracket
28. Washer (Post-SB24555)
29. Bolt (Post-SB24555)
30. Nut (Post-SB24014)
31. Bracket (Post-SB24014)



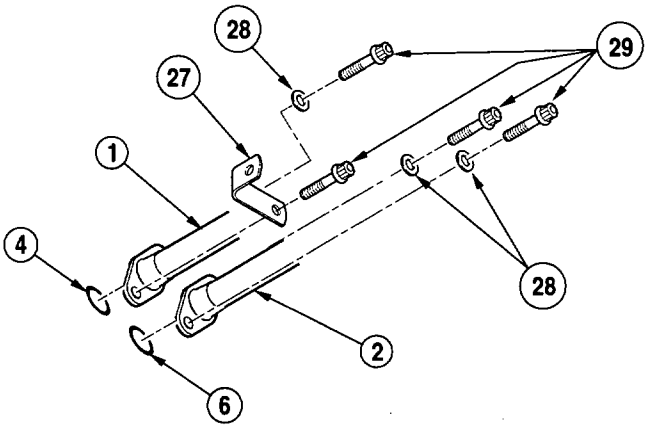
DETAIL A
PRE-SB24367
PRE-SB24555



DETAIL A
PRE-SB24367
POST-SB24555



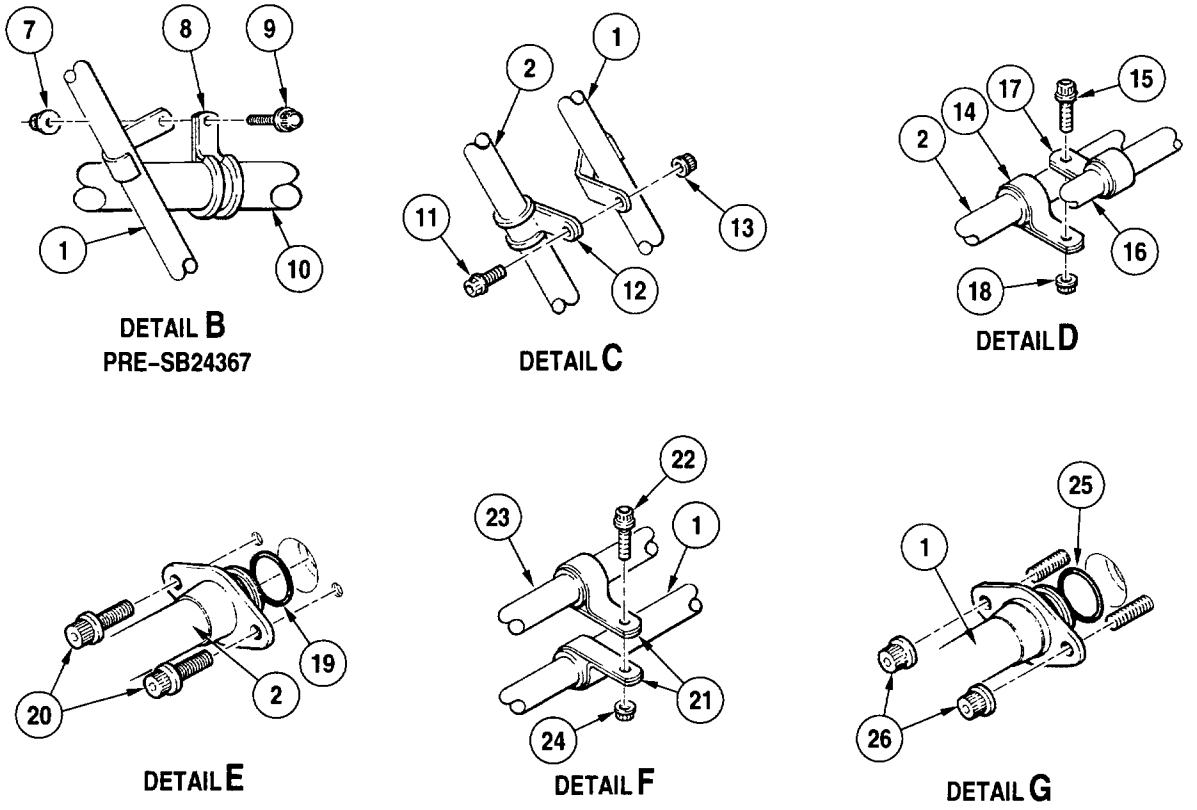
DETAIL A
POST-SB24367
PRE-SB24555



DETAIL A
POST-SB24367
POST-SB24555

C113919

Fuel Bypass Tubes - Removal/Installation
Figure 204 (Sheet 2)



C113885

Fuel Bypass Tubes - Removal/Installation
Figure 204 (Sheet 3)

CAUTION: DO NOT LUBRICATE NUTS.

(5) Install two loop clamps (21) with bolt (22) and nut (24). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(6) Pre-SB24555: Lubricate new performed packings (6 and 19) and install on fuel bypass tube (2). Install fuel bypass tube on engine with two bolts (5) and two bolts (20). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(7) Post-SB24555: Lubricate new performed packings (6 and 19) and install on fuel bypass tube (2). Install fuel bypass tube on engine with two washers (28), two bolts (29) and two bolts (20). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(8) Install loop clamp (12) with bolt (11) and nut (13). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

CAUTION: DO NOT LUBRICATE NUTS.

(9) Install loop clamps (14 and 17) with bolt (15) and nut (18). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(10) Post-SB24014: Install heat shield (31) with two nuts (30). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

9. IGV Fuel Tubes

A. Removal (Ref. Fig. 205)

(1) Remove nut (7), bolt (5) and loop clamps (6).

(2) Post-SB24084: Remove nut (17), bolt (16) and loop clamp (18) from bracket (19).

(3) Remove bolts (13 and 10) and remove fuel pressure tube (1). Discard preformed packings (11 and 14).

(4) Post-SB24414: Remove fuel strainer (15).

CAUTION: DIRT MUST NOT ENTER THE FUEL SYSTEM. TAKE ALL NECESSARY PRECAUTIONS TO AVOID INGRESS OF FOREIGN MATERIAL. WHEREVER POSSIBLE, INSTALL PROTECTIVE CAPS OR PLUGS ON ALL EXPOSED OPENINGS BEFORE REMOVING THE FUEL TUBES.

(5) Remove bolts (3 and 8) and remove fuel pressure tube (4). Discard preformed packings (2 and 9).

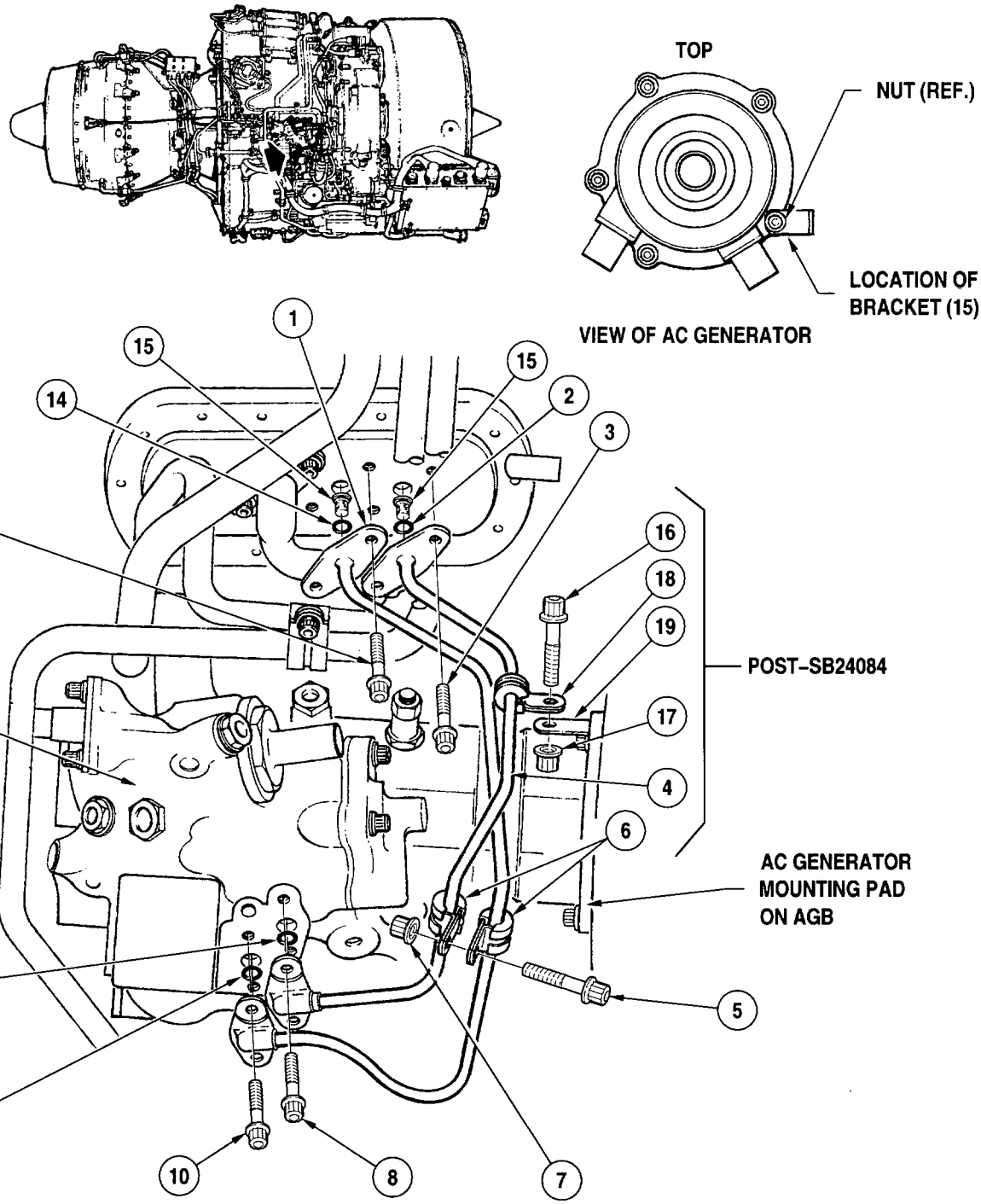
(6) Post-SB24414: Remove fuel strainer (15).

B. Installation (Ref. Fig. 205)

(1) Lubricate new preformed packings (2 and 9) with engine oil (PWC03-001) and install on fuel pressure tube (4).

(2) Post-SB24414: Install fuel strainer (15).

(3) Install fuel pressure tube (4) with bolts (3 and 8). Torque 36 to 40 lb.in. (4.0-4.6 Nm).



IGV Fuel Pressure Tubes - Removal/Installation
Figure 205

Key to Figure 205

1. Fuel Pressure Tube (IGV "B")
2. Preformed Packing
3. Bolt
4. Fuel Pressure Tube (IGV "A")
5. Bolt
6. Loop Clamp
7. Self-Locking Nut
8. Bolt
9. Preformed Packing
10. Bolt
11. Preformed Packing
12. HMU (Ref.)
13. Bolt
14. Preformed Packing
15. Fuel Strainer (Post-SB24414)
16. Bolt (Post-SB24084)
17. Nut (Post-SB24084)
18. Clamp (Post-SB24084)
19. Bracket (Post-SB24084)

(4) Lubricate new preformed packings (11 and 14) with engine oil (PWC03-001) and install on fuel pressure tube (1).

(5) Post-SB24414: Install fuel strainer (15).

(6) Install fuel pressure tube (1) with bolts (10 and 13). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

CAUTION: DO NOT LUBRICATE NUTS.

(7) Install two loop clamps (6) with bolt (5) and nut (7). Torque 27 to 30 lb.in. (3.10-3.4 Nm).

(8) Post-SB24084: Install loop clamp (18) to bracket (19) and secure with bolt (16) and nut (17). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

10. Fits, Clearances and Torque Loadings

TABLE 201, Fits and Clearances

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
Not Applicable						

TABLE 202, Torque and Stretch

REF. NO.	Name	Limits Min.	Limits Max.
Not Applicable			

TABLE 203, Spring Pressures

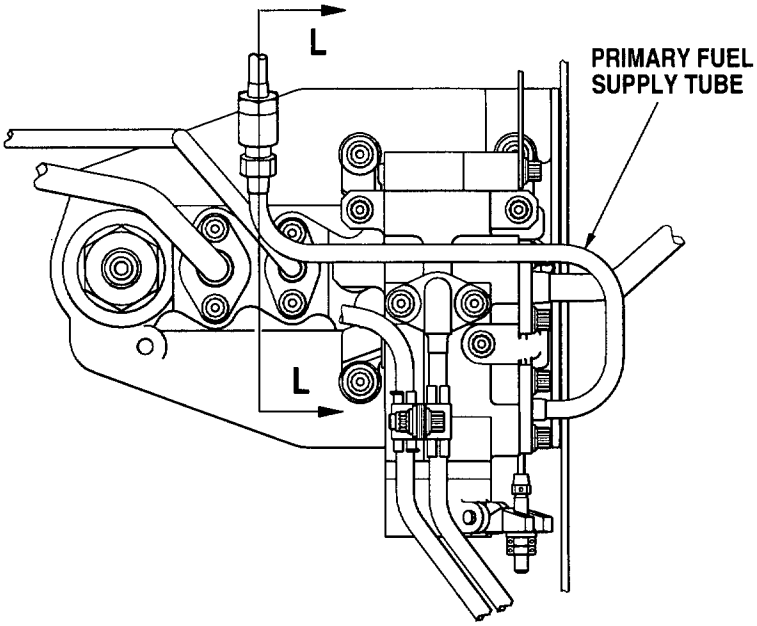
REF. NO.	Name	Limits Min.	Limits Max.
Not Applicable			

TABLE 204, Special Assembly Procedures

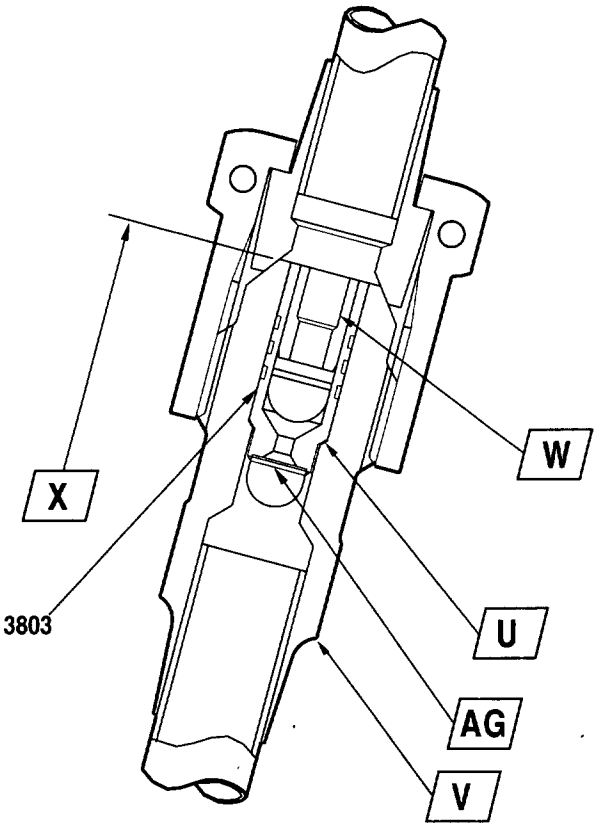
REF. NO.	Name	Limits Min.	Limits Max.
3803	Restrictor Installation Procedure (1) Insert restrictor body U into bore of tube assy V until fully seated on shoulder AG. (2) Drive expander pin W into bore of restrictor body U until exposed end of W and exposed end of U are flush ± .005 in. (0.127 mm). (3) Ends of body U and pin W are to be flush or under surface of tube assy V after installation.		

TABLE 205, Backlash

REF. NO.	Name	Limits Min.	Limits Max.
Not Applicable			



VIEW ON FUEL SHUT-OFF AND DUMP VALVE



SECTION L-L

C33752

Fuel Tubes - Fits and Clearances
Figure 206

FUEL PUMP - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after dis-assembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-089	Lockwire

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Fuel Pump

   A. Removal (Ref. Fig. 201)

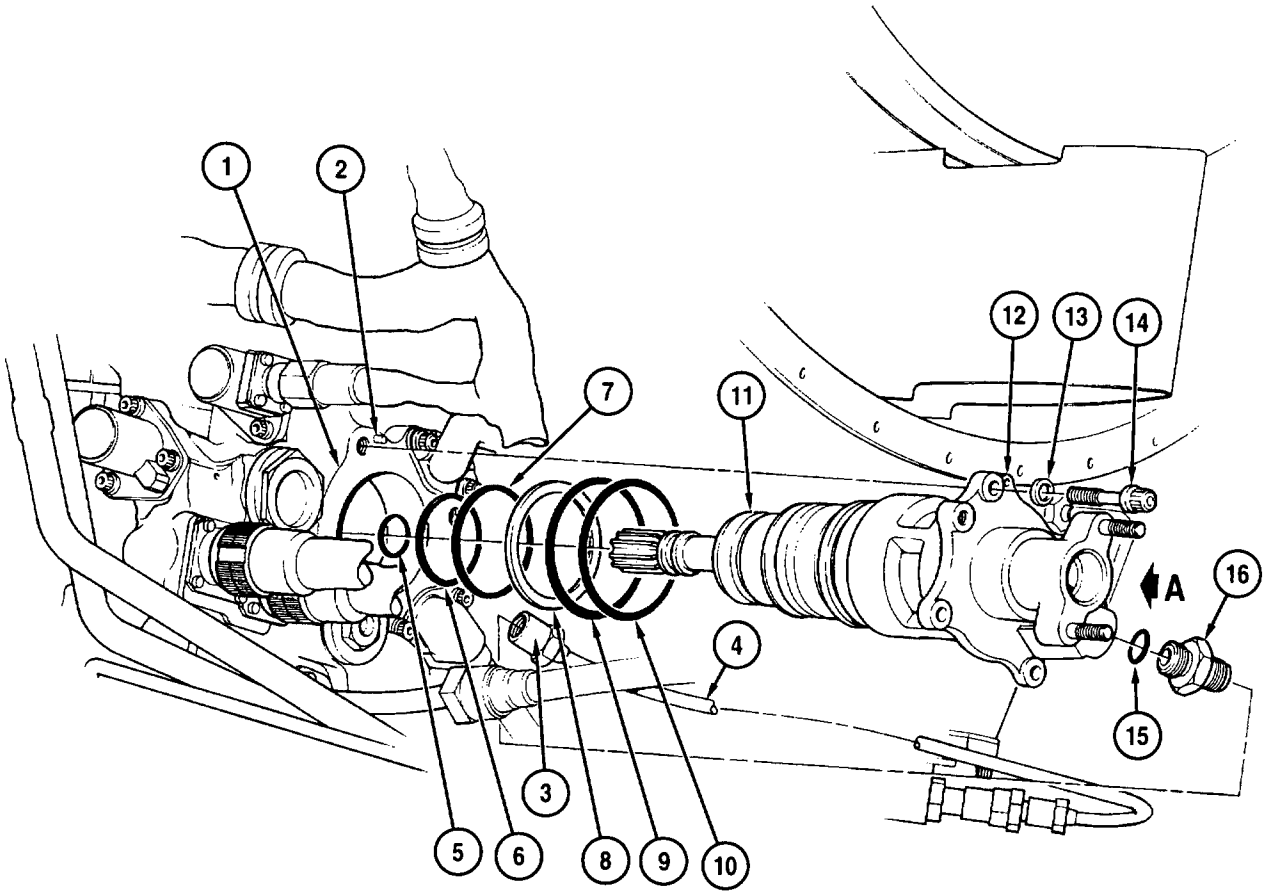
      CAUTION: DIRT MUST NOT ENTER THE FUEL SYSTEM. TAKE ALL NECESSARY PRECAUTIONS TO AVOID INGRESS OF FOREIGN MATERIAL. WHEREVER POSSIBLE, INSTALL PROTECTIVE CAPS OR PLUGS ON ALL EXPOSED OPENINGS.

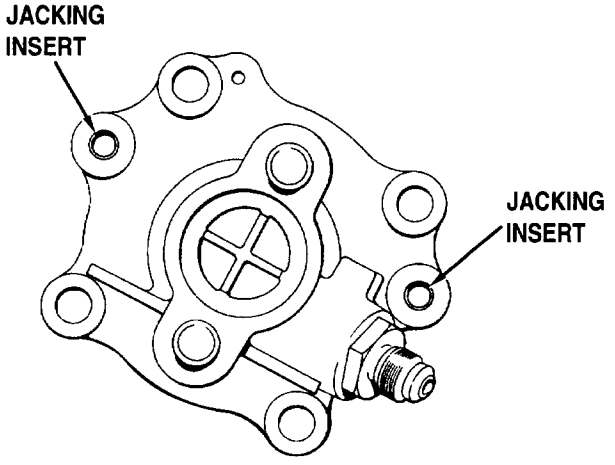
      (1) Disconnect airframe fuel supply from fuel pump inlet (Ref. Airframe Maintenance Manual) and cap openings.

      (2) Remove lockwire and loosen coupling nut (3).

      (3) Remove four bolts (14) and washers (13).

      (4) Install two jacking screws (thread size 0.250-28 UNJF) in flange of fuel pump (11) (Ref. View A).





VIEW **A**

C19002

Fuel Pump - Removal/Installation
Figure 201

Key to Figure 201

1. Hydromechanical Metering Unit (HMU)
2. Locating Pin
3. Coupling Nut
4. Fuel Tube (Fuel Waste Ejector Return to Fuel Pump)
5. Preformed Packing
6. Preformed Packing
7. Preformed Packing
8. Packing Retainer
9. Preformed Packing
10. Preformed Packing
11. Fuel Pump
12. Locating Hole (Ref.)
13. Washer
14. Bolt
15. Preformed Packing
16. Nipple (Post-SB24006)

CAUTION: DIRT MUST NOT ENTER THE FUEL SYSTEM. TAKE ALL NECESSARY PRECAUTIONS TO AVOID INGRESS OF FOREIGN MATERIAL. WHEREVER POSSIBLE, INSTALL PROTECTIVE CAPS OR PLUGS ON ALL EXPOSED OPENINGS BEFORE REMOVING THE FUEL PUMP.

CAUTION: USE CARE WHEN REMOVING FUEL PUMP, SO THAT NO DAMAGE OCCURS TO FLANGE OF FUEL PUMP OR MATING SURFACE OF HMU.

(5) Remove fuel pump from HMU (1) by turning jacking screws inwards.

(6) If fuel pump driveshaft disconnects from fuel pump, remove from AGB gearshaft.

(7) Remove and discard preformed packings (5, 6, 7, 9, and 10) and packing retainer (8).

(8) Remove nipple (16) (Post-SB24006) and discard preformed packing (15).

NOTE: For Pre-SB24006 fuel pump, nipple (16) is part of the fuel pump and should not be removed from the pump.

(9) For Post-SB24589 engines:

NOTE: The fuel pump is an integral part of the Post-SB24589 hydromechanical fuel control unit (Ref. Ch. 73-20-01, HYDROMECHANICAL METERING UNIT (HMU) - MAINTENANCE PRACTICES). Removal of the fuel pump from the Post-SB24589 HMU is not required.

B. Installation (Ref. Fig. 201)

(1) Install new preformed packing (15) on nipple (16) (Post-SB24006) and install nipple in fuel pump (11). Torque 65 to 75 lb.in. (7.5-8.5 Nm).

(2) Lubricate new preformed packings (5, 6, 7, 9 and 10) and packing retainer (8) with engine oil (PWC03-001) and install on fuel pump.

(3) If fuel pump driveshaft has separated from fuel pump assembly, install in fuel pump.

NOTE: For fuel pump parts breakdown and additional information refer to CMM 73-10-02 (Vickers).

(4) Align locating pin (2) on HMU interface with hole (12) in fuel pump flange. Carefully insert fuel pump into HMU.

(5) Secure fuel pump with four bolts (14) and washers (13). Torque 85 to 95 lb.in. (9.6-10.7 Nm).

(6) Connect fuel waste ejector return tube (4) to fuel pump (11) with coupling nut (3). Torque 90 to 100 lb.in. (10.2-11.3 Nm) and lockwire (PWC05-089).

NOTE: For fuel pump parts breakdown and additional information refer to CMM 73-10-02 (Vickers).

(7) For Post-SB24589 engines:

NOTE: The fuel pump is an integral part of the Post-SB24589 hydromechanical fuel control unit (Ref. Ch. 73-20-01, HYDROMECHANICAL METERING UNIT (HMU) - MAINTENANCE PRACTICES). Installation of the fuel pump in the Post-SB24589 HMU is not required.

6. Adjustment/Test

Refer to Chapter 71-00-00, ADJUSTMENT/TEST for required checks following installation of fuel pump.

FUEL FILTER AND FUEL WASTE EJECTOR - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after dis-assembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC01-001	DELETED.
PWC03-001	Oil, Engine Lubricating
PWC05-019	Compound, Lapping
PWC05-041	Dye, Layout
PWC05-089	Lockwire
PWC11-027	Solvent, Petroleum

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC60786	Pressure Test Kit
PWC60787	Adapter Plate
PWC60788	Lapping Handle

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

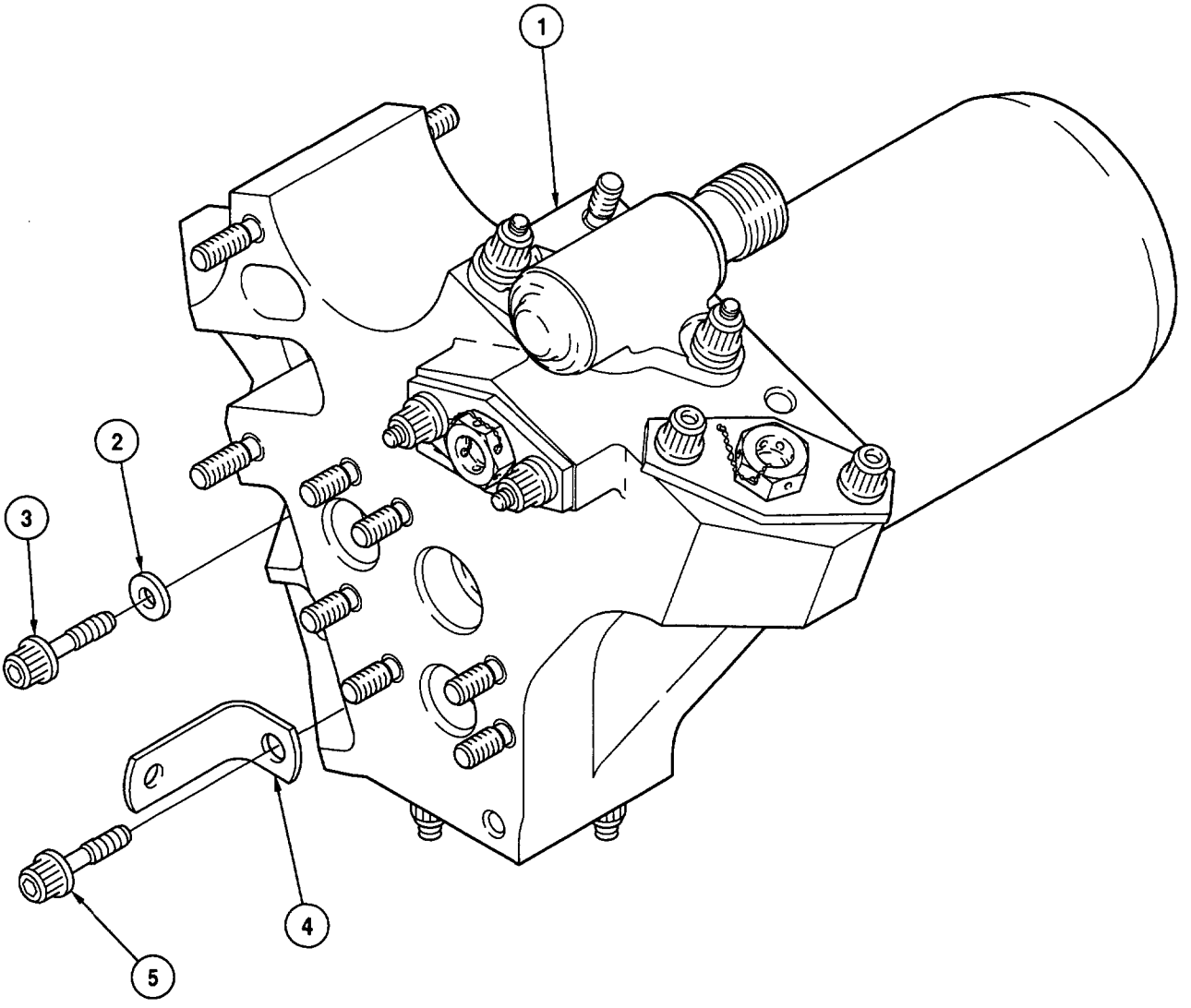
5. Fuel Filter Housing

   A. Removal from Engine (Ref. Fig. 201)

      (1) Support fuel filter housing (1) and remove two bolts (3), washers (2), bolt (5) and bracket (4) and remove fuel filter housing from accessory gearbox.

      (2) Place protective covers on all fuel filter housing openings.

      (3) Place removed parts in sealable plastic bags and identify with names and part numbers of contents.



C31498

Fuel Filter Housing Assembly - Removal/Installation
Figure 201

Key to Figure 201

1. Fuel Filter Housing Assembly
2. Washer
3. Bolt
4. Bracket
5. Bolt

B. Removal of Fuel Filter Element from Housing (Ref. Fig. 202)

(1) Remove three nuts (11) and flat washers (12) and remove fuel filter cover (10) from fuel filter housing assembly (25). Remove and discard preformed packing (13).

(2) Remove retaining ring (9) and fuel filter element (7) from fuel filter cover. Remove and discard preformed packing (8).

C. Removal of Fuel Differential Pressure Switch and Filter Bypass Valve (Ref. Fig. 202)

CAUTION: FUEL DIFFERENTIAL PRESSURE SWITCH (3) IS UNDER SPRING TENSION. USE CARE WHEN REMOVING.

(1) Remove two nuts (2) and flat washers (1) and carefully remove fuel differential switch (3) and spring (5). Remove and discard preformed packings (4, 6).

(2) Remove filter bypass valve (26) from fuel filter housing (25).

D. Removal of Pre-SB24042 Fuel Temperature Sensor Adapter (Ref. Fig. 202)

(1) Remove lockwire and remove machine thread plug (28) from fuel temperature sensor adapter (30). Remove and discard preformed packing (29).

(2) Remove two nuts (27) and fuel temperature sensor adapter (30). Remove and discard preformed packing (31).

E. Removal of Fuel Filter Drain Adapter (Ref. Fig. 202)

(1) Remove lockwire and remove machine thread plug (16). Remove and discard preformed packing (17).

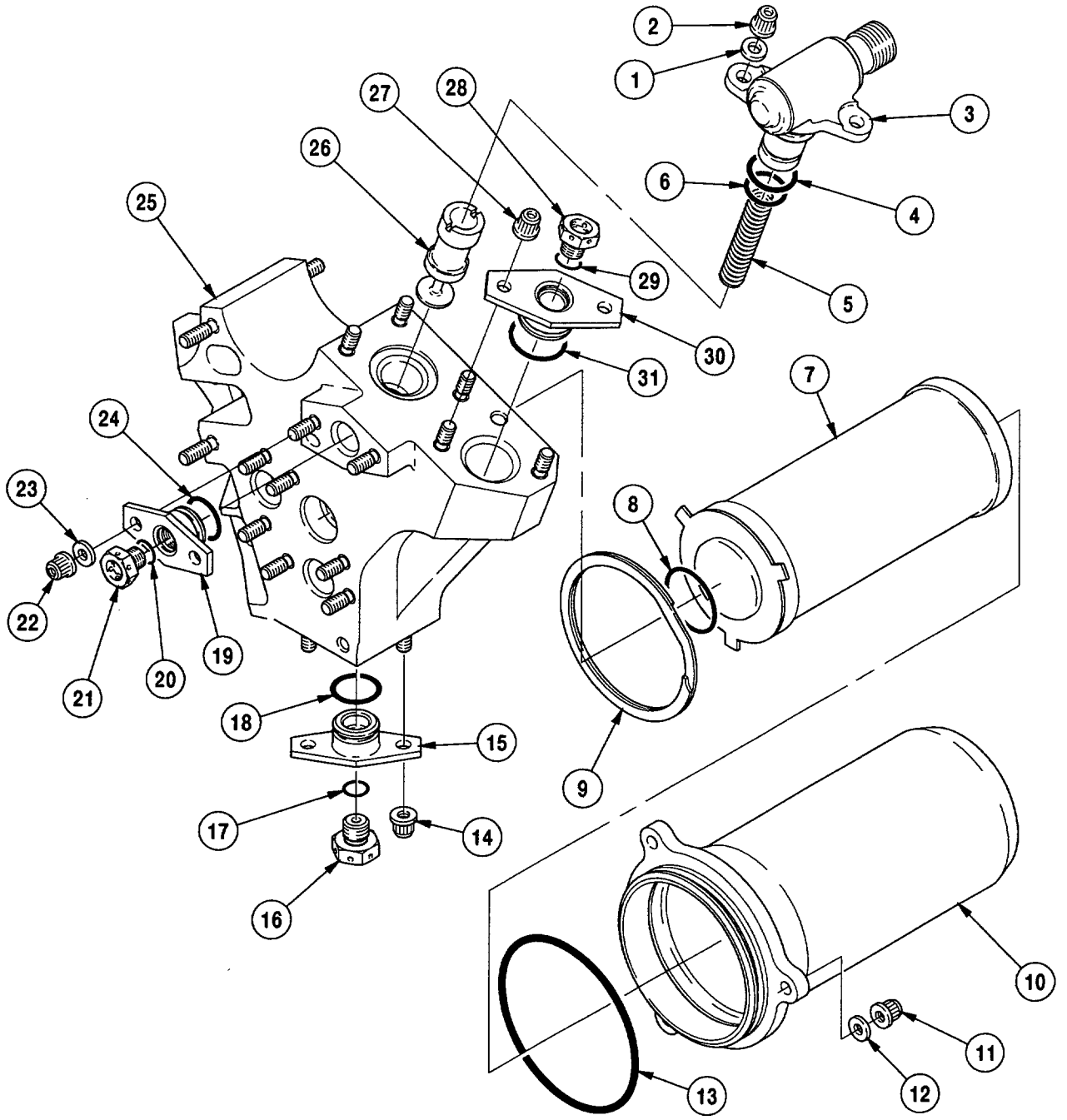
(2) Remove two nuts (14) and fuel filter drain adapter (15). Remove and discard preformed packing (18).

F. Removal of Air Bleed Adapter (Ref. Fig. 202)

(1) Remove lockwire and remove bleeder tube plug (21). Remove and discard preformed packing (20).

(2) Remove two nuts (22) and flat washers (23). Remove air bleed adapter (19). Remove and discard preformed packing (24).

(3) Place all removed parts in clean, sealable plastic bags and tag with part numbers and description of contents.



C31706

Disassembly of Fuel Filter Housing
Figure 202

Key to Figure 202

1. Flat Washer
2. Nut
3. Fuel Pressure Differential Switch
4. Preformed Packing
5. Helical Compression Spring
6. Preformed Packing
7. Fuel Filter Element
8. Preformed Packing
9. Retaining Ring
10. Fuel Filter Cover
11. Nut
12. Flat Washer
13. Preformed Packing
14. Nut
15. Fuel Filter Drain Adapter
16. Machine Thread Plug
17. Preformed Packing
18. Preformed Packing
19. Air Bleed Adapter
20. Preformed Packing
21. Bleeder Tube Plug
22. Nut
23. Flat Washer
24. Preformed Packing
25. Fuel Filter Housing Assembly
26. Filter Bypass Valve
27. Nut
28. Machine Thread Plug
29. Preformed Packing
30. Fuel Temperature Sensor Adapter
31. Preformed Packing

G. Verify Seating of Bypass Valve (Ref. Fig. 202)

(1) Mount fuel filter housing on adapter plate (PWC60787) and secure adapter plate in vise.

(2) Apply a thin even coat of layout dye (PWC05-041) to face of bypass valve (26).

(3) Insert valve (26) into fuel filter housing (25), allowing valve to contact valve seat.

CAUTION: DO NOT ROTATE VALVE IN HOUSING.

(4) Remove valve from housing and inspect. A continuous ring around contact area should be visible. A broken ring will indicate incomplete valve seating.

(5) Thoroughly clean valve face and valve seat (Ref. Cleaning).

NOTE: If above steps indicate lapping of valve seat is required, proceed to step (6). If lapping is not required, proceed to Subpara. H.

(6) Apply engine oil to valve face.

(7) Using lapping compound (PWC05-019) and lapping handle (PWC60788), lap valve face to valve seat.

(8) Thoroughly clean parts using clean varsol (Ref. Cleaning).

(9) Verify valve seating and repeat procedure until satisfactory result is obtained.

H. Assembly of Fuel Filter Bypass Valve (Ref. Fig. 202)

(1) Install bypass valve (26) and spring (5) into housing (25).

(2) Lubricate two new preformed packings (4, 6) and install on fuel pressure differential switch (3).

(3) Install switch (3) on housing (25) and secure with two flat washers (1) and self-locking nuts (2). Torque nuts 23 to 26 lb.in. (2.6-3.0 Nm).

(4) Functionally check bypass valve as follows:

(a) Install adapter (part of pressure test kit) (PWC60786) at fuel inlet port of housing (25).

(b) Blank off housing ports using seven slave preformed packings and seven plugs supplied with pressure test kit (PWC60786).

(c) Remove assembly from adapter plate and connect to fuel pressure rig.

(d) With fuel at 20 psi (137.9 kPa) check for leaks past valve. Maximum allowable leakage is 10 cc/min.

(e) Remove fuel filter housing from test rig and install on adapter plate (PWC60787). Remove adapter and plug installed in steps (a) and (b) preceding.

I. Assembly of Fuel Filter Housing (Ref. Fig. 202)

(1) Lubricate new preformed packing (24) and install on air bleed adapter (19).

(2) Install air bleed adapter (19) on fuel filter housing (25) and secure with two flat washers (23) and self-locking nuts (22). Torque nuts 23 to 26 lb.in. (2.6-3.0 Nm).

(3) Lubricate new preformed packing (20) and install on bleeder tube plug (21). Install plug into adapter (19) and torque 40 to 50 lb.in. (4.6-5.6 Nm).

(4) Lubricate new preformed packing (31) and install on fuel temperature sensor adapter (30). Install adapter on fuel filter housing (25) and secure with two self-locking nuts (27). Torque nuts 23 to 26 lb.in. (2.6-3.0 Nm).

(5) Lubricate new preformed packing (29) and install on machine thread plug (28). Install plug into adapter (30). Torque plug 65 to 75 lb.in. (7.5-8.0 Nm) and lockwire (PWC05-089).

(6) Lubricate new preformed packing (13) and install on fuel filter cover (10).

(7) Lubricate new preformed packing (8) and install on fuel filter element (7). Install filter element into filter cover (10) and secure with retaining ring (9).

CAUTION: WHEN INSTALLING FUEL FILTER COVER ON FUEL FILTER HOUSING, MAKE SURE FUEL FILTER ELEMENT IS CORRECTLY INSTALLED OVER HOUSING SLEEVE.

CAUTION: MAKE SURE FILTER COVER IS FULLY SEATED BEFORE TIGHTENING AND TORQUING NUTS (11).

(8) Install fuel filter cover assembly (10) to fuel filter housing (25) and secure with three flat washers (12) and self-locking nuts (11). Torque nuts 23 to 26 lb.in (2.6-3.0 Nm).

(9) Lubricate new preformed packing (18) and install on fuel filter drain adapter (15). Install adapter on fuel filter housing (25) and secure with two nuts (14). Torque nuts 23 to 26 lb.in (2.6-3.0 Nm).

(10) Lubricate new preformed packing (17) and install on machine thread plug (16). Install plug into adapter (15). Torque plug 65 to 75 lb.in. (7.5-8.0 Nm) and lockwire (PWC05-089).

(11) Remove housing assembly from holding fixture.

(12) Place protective covers on all fuel filter housing openings.

(13) Place assembled fuel filter housing in clean, sealable plastic bag and tag with description and part number of contents.

J. Installation on Engine (Ref. Fig. 201)

(1) Locate fuel filter housing (1) on two dowel pins on accessory gearbox and secure with two washers (2) and bolts (3). Torque bolts 27 to 30 lb.in. (3.0-3.4 Nm).

(2) Install bracket (4) and bolt (5) in bottom mounting hole of fuel filter housing. Torque bolt 27 to 30 lb.in. (3.0-3.4 Nm).

6. Fuel Filter

A. Removal from Engine (Ref. Fig. 203)

(1) Remove three nuts (8) and washers (7) and separate filter cover (6) from filter housing (1). Remove and discard preformed packing (5).

(2) Remove retaining ring (2) from filter cover (6) and remove fuel filter (4). Remove and discard preformed packing (3).

B. Installation on Engine (Ref. Fig. 203)

(1) Install fuel filter element (4) in filter cover (6) and secure with retaining ring (2).

(2) Lubricate new preformed packing (3) with engine oil (PWC03-001) and install in fuel filter element (4).

(3) Lubricate new preformed packing (5) with engine oil (PWC03-001) and install in filter cover (6).

CAUTION: WHEN INSTALLING FUEL FILTER COVER ON FUEL FILTER HOUSING, MAKE SURE FUEL FILTER ELEMENT IS CORRECTLY INSTALLED OVER HOUSING SLEEVE.

CAUTION: MAKE SURE FILTER COVER IS FULLY SEATED BEFORE TIGHTENING AND TORQUING NUTS (8).

(4) Install filter cover assembly on fuel filter housing (1) and secure with three nuts (8) and washers (7). Tighten and torque nuts 23 to 26 lb.in (2.6-3.0 Nm).

7. Fuel Waste Ejector

A. Removal (Ref. Fig. 204)

(1) Loosen nut (16) on transfer tube (15) and disconnect tube from waste ejector inlet elbow (14).

(2) Loosen nuts (7 and 9) and disconnect transfer tubes (6 and 10) from outlet fitting (8).

(3) Support fuel waste ejector (4) and remove bolts (5), nuts (1) and washers (2) securing ejector to mounting bracket (3).

(4) Install protective caps and/or plugs on exposed openings.

(5) If necessary, remove mounting bracket (3) from outer bypass duct (18) by removing bolts (17).

B. Installation (Ref. Fig. 204)

(1) Install mounting bracket (3) on outer bypass duct (18) (if applicable) with bolts (17).

(2) If necessary, install fittings on fuel waste ejector as follows:

(a) Remove protective plugs and/or caps.

(b) Install elbow (14), using new backing ring (12) and new preformed packing (11). Do not tighten nut (13) at this time.

(3) Locate fuel waste ejector (4) on mounting bracket (3) and secure with four bolts (5), washers (2) and self-locking nuts (1). Tighten and torque 36 to 40 lb.in. (4.0-4.6 Nm).

(4) Align tubes (6 and 10) with ejector fitting (8). Secure with nuts (7 and 9), tighten and torque nuts 90 to 100 lb.in. (10.2-11.3 Nm).

(5) Align transfer tube (15) with elbow (14). Hold elbow, tighten and torque nut (13) 38 to 42 lb.in. (4.3 - 4.8 Nm). Hold elbow, tighten and torque nut (16) 90 to 100 lb.in. (10.2-11.3 Nm).

(6) Lockwire (PWC05-089) nuts (7 and 9).

8. Cleaning

A. Fuel Filter Housing, Filter Cover and Bypass Valve

CAUTION: DO NOT EXTEND, CONTRACT, BEND OR OTHERWISE DAMAGE FUEL FILTER BYPASS VALVE SPRING.

(1) Wash parts in clean petroleum solvent (PWC11-027). If necessary, use a nylon bristle brush to remove contaminants.

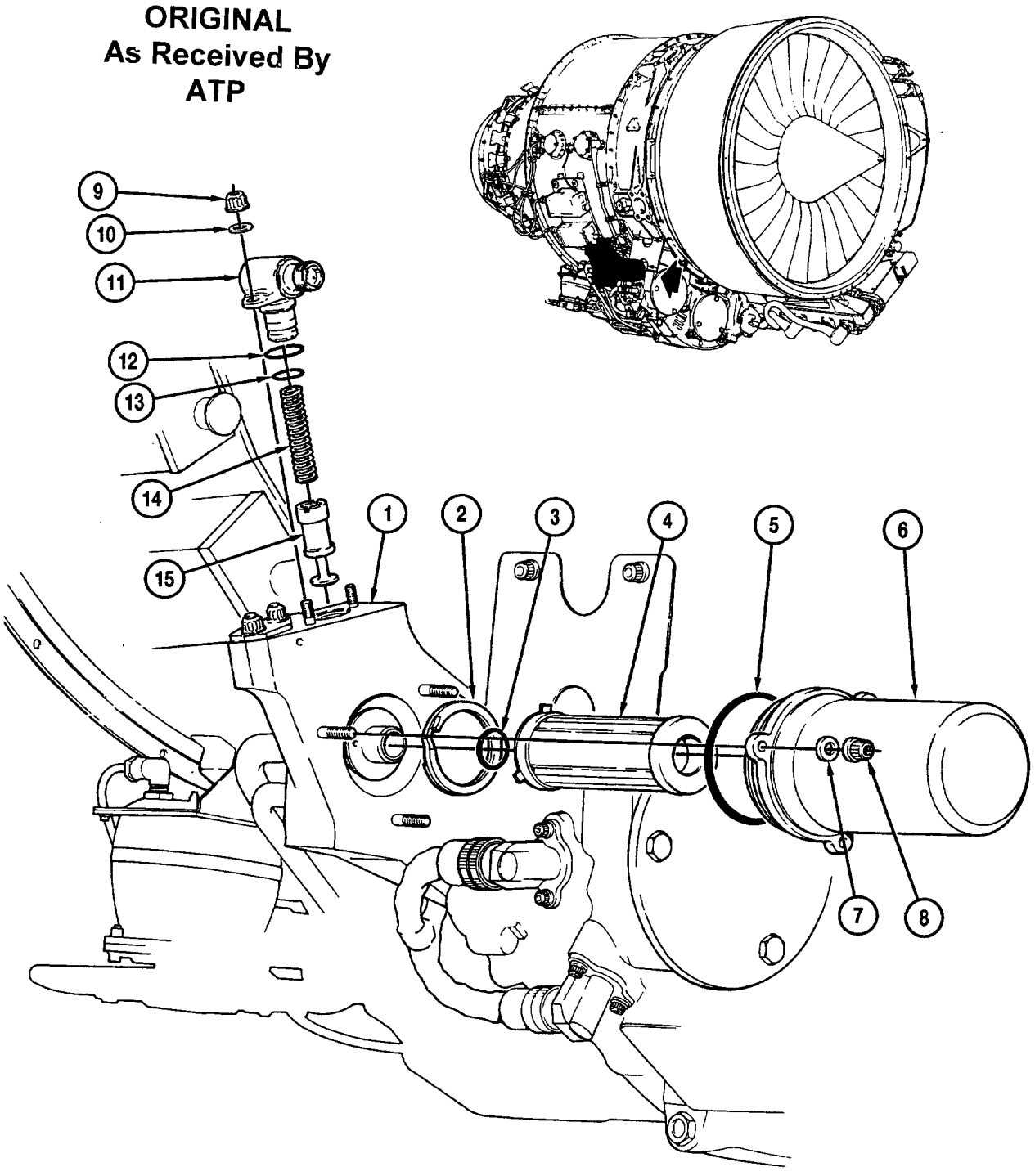
(2) Dry parts using clean, dry, filtered compressed air blast, or allow parts to stand and air dry.

9. Inspection/Check

A. Fuel Filter

(1) Insert a small lamp into the inside bore of the filter element.

(2) Visually inspect filter element for breaks, punctures or evidence of collapse. There must be no loose particles, broken bonds or joints.

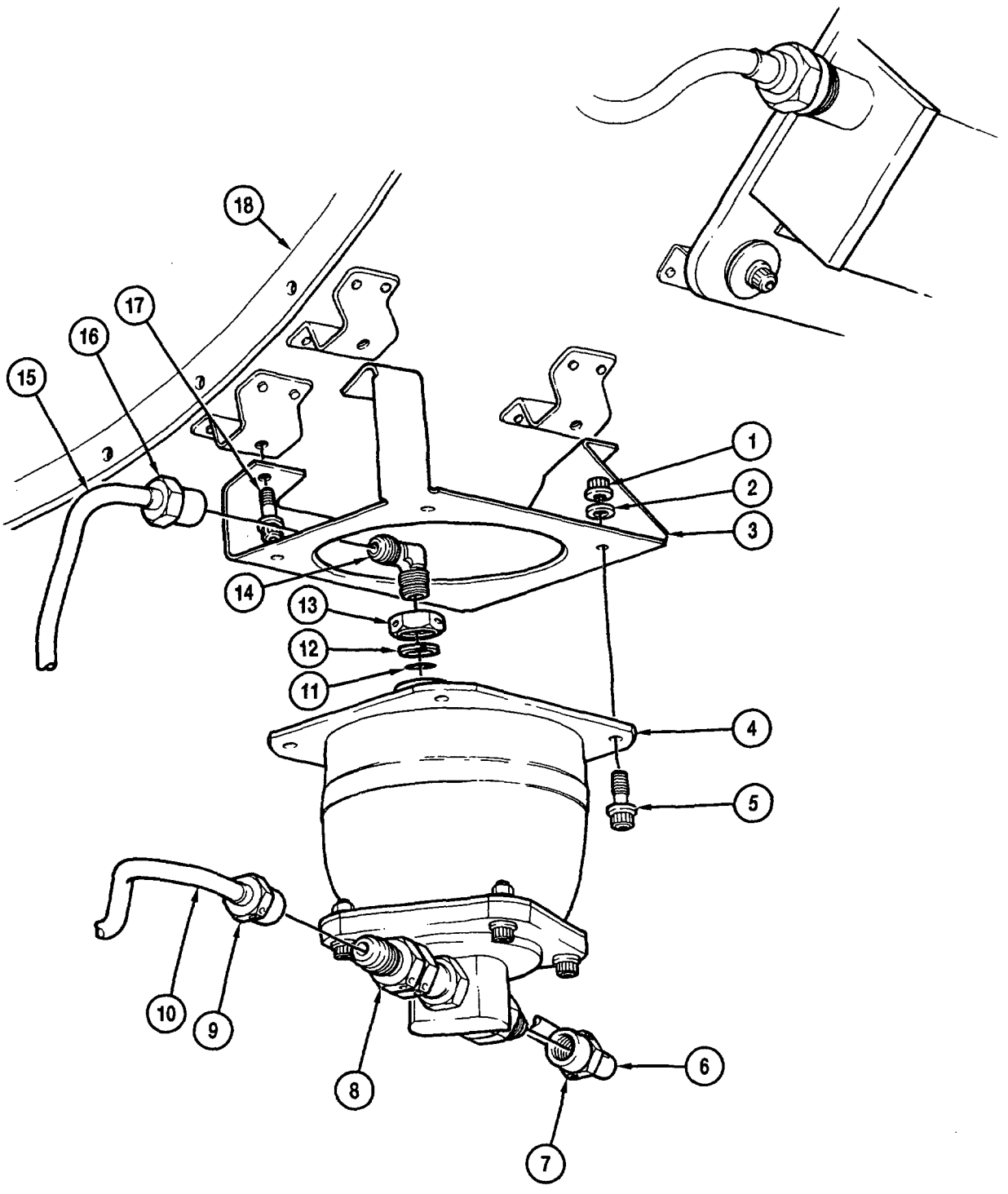


C18662

Fuel Filter - Removal/Installation
Figure 203

Key to Figure 203

1. Fuel Filter Housing
2. Retaining Ring
3. Preformed Packing
4. Fuel Filter Element
5. Preformed Packing
6. Fuel Filter Cover
7. Washer
8. Self-locking Nut
9. Self-locking Nut
10. Washer
11. Fuel Pressure Differential Switch
12. Preformed Packing
13. Preformed Packing
14. Spring
15. Bypass Valve



Fuel Waste Ejector - Removal/Installation
Figure 204

Key to Figure 204

1. Self-locking Nut
2. Washer
3. Mounting Bracket
4. Fuel Waste Ejector
5. Bolt
6. Transfer Tube
7. Nut
8. Outlet Fitting
9. Nut
10. Transfer Tube
11. Preformed Packing
12. Backing Ring
13. Nut
14. Elbow
15. Transfer Tube
16. Nut
17. Bolt
18. Outer Bypass Duct
19. Washer Post-SB24222

FUEL MANIFOLD - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addressess.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-050	Nitrogen
PWC05-089	Lockwire
PWC06-004A	Compound, Antiseize
PWC11-046	Cleaner
PWC11-049	Cleaner
PWC11-061	Cleaner
PWC11-063	Cleaner
PWC11-064	Cleaner
PWC11-065	Cleaner

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name	Application
PWC43572	DELETED	Replaced by PWC61148
PWC60710	Clamp	Part of Test Kit PWC60718
PWC60711	Adaptor	Part of Test Kit PWC60718
PWC60712	Plug	Part of Test Kit PWC60718
PWC60718	Test Kit	
PWC61148	Locator	Three required
PWC61792	Leak Check Fixture	Part of Test Kit PWC60718

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Primary Fuel Tube Assembly

CAUTION: EXTREME CARE MUST BE EXERCISED WHEN HANDLING FUEL NOZZLE ASSEMBLIES. FINGERPRINTS ON THE ORIFICE MAY PRODUCE POOR SPRAY PATTERN. CLEAN, LINT-FREE COTTON GLOVES OR SURGICAL GLOVES SHOULD BE WORN AT ALL TIMES WHEN HANDLING IS REQUIRED.

CAUTION: REPLACEMENT FUEL NOZZLES MUST BE FROM THE SAME MANUFACTURER AS ONE(S) REMOVED.

A. Removal (Ref. Fig. 201)

(1) Post-SB24331: Remove bolt (13) and nut (14) securing tube bracket to the No. 4 scavenge oil tube.

(2) Remove two bolts (7) securing fuel tube assembly (6) to bypass duct.

(3) Remove bolt (11) and self-locking nut (4) securing loop clamp (5) to angle bracket (10).

(4) Remove and discard lockwire securing two coupling nuts (3).

(5) Loosen two coupling nuts (3) and remove primary fuel tube assembly (6).

(6) Remove two transfer tubes (2). Remove and discard four preformed packings (1).

(7) Remove and discard two preformed packings (8 and 9).

(8) Remove loop clamp (5) from primary fuel tube assembly (6).

(9) Install closures on all exposed openings.

B. Installation (Ref. Fig. 201)

(1) Position loop clamp (5) on primary fuel tube assembly (6).

(2) Lubricate and install two new preformed packings (8 and 9) on primary fuel tube assembly (6).

(3) Lubricate and install four new preformed packings (1) on two fuel transfer tubes (2).

(4) Insert two fuel transfer tube assemblies (2) into two primary fuel nozzle assemblies (12).

(5) Install primary fuel tube assembly (6) by pushing adapter into outer bypass duct into two fuel transfer tubes (2) into primary fuel nozzles.

(6) Post-SB24331: Install bolt (13) and nut (14) to loop clamp (15) securing tube bracket to the No. 4 scavenge oil tube. Torque nut (14) 36 to 40 lb.in. (4.0-4.6 Nm).

(7) Secure tube adapter to outer bypass duct using two bolts (7). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(8) Pre-SB24331:

(a) Lubricate threads of two coupling nuts (3) with engine oil (PWC03-001).

(b) Secure two coupling nuts (3) to two primary fuel nozzles (12). Torque 320 to 350 lb.in. (36-40 Nm).

(9) Post-SB24331:

CAUTION: MAKE SURE THE ANTI-SEIZE COMPOUND MIXTURE WILL NOT PENETRATE THE FUEL PASSAGE OF THE PRIMARY NOZZLE.

(a) Lubricate threads of coupling nuts (3) with mixture of 20% engine oil (PWC03-001) and 80% anti-sieze compound (PWC06-004A).

(b) Secure two coupling nuts (3) to two primary fuel nozzles (12). Torque 225 to 250 lb.in. (25-28 Nm).

(10) Lockwire (PWC05-089) two coupling nuts (3) to bolts securing primary fuel nozzles.

(11) Secure loop clamp (5) to angle bracket (10) using bolt and nut (11 and 4). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(12) Refer to Chapter 71-00-00 for required checks following installation of primary fuel tubes.

6. Primary Fuel Manifold and Nozzles

CAUTION: EXTREME CARE MUST BE EXERCISED WHEN HANDLING FUEL NOZZLE ASSEMBLIES. FINGERPRINTS ON THE ORIFICE MAY PRODUCE POOR SPRAY PATTERN. CLEAN, LINT-FREE COTTON GLOVES OR SURGICAL GLOVES SHOULD BE WORN AT ALL TIMES WHEN HANDLING IS REQUIRED.

CAUTION: REPLACEMENT FUEL NOZZLES MUST BE FROM THE SAME MANUFACTURER AS ONE(S) REMOVED.

A. Removal (Ref. Fig. 202)

(1) Remove ignition exciters and mounting plate (Ref. 74-10-01).

(2) Remove bolts (7) (Pre-SB24032), or nuts (7) (Post-SB24032) and washers (6).

(3) Post-SB24177/Pre-SB24344: Remove outer cover (5) and gasket (23). Discard gasket.

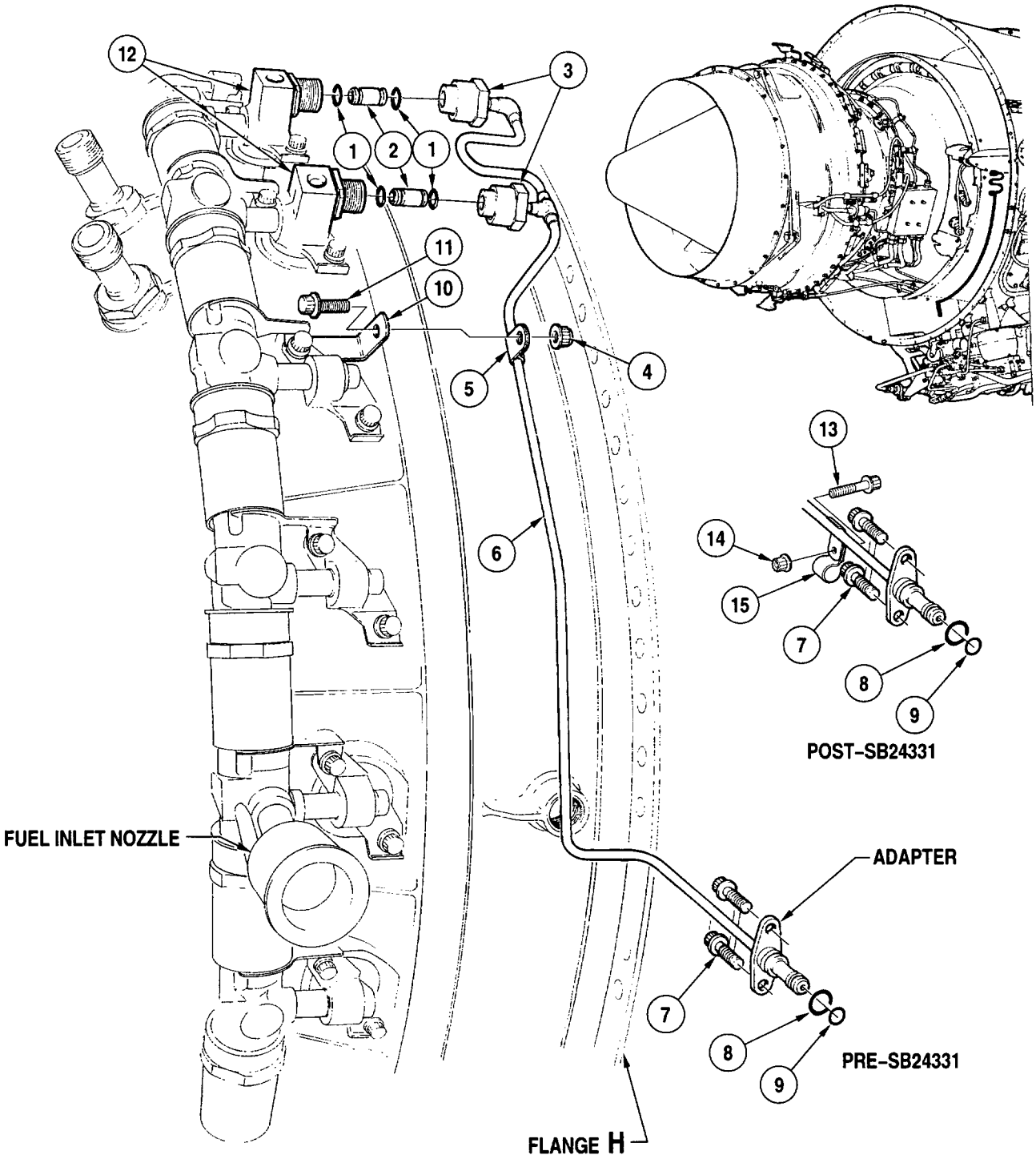
(4) Post-SB24344: Remove 28 gaskets (22) and outer cover (5). Discard gaskets.

(5) Remove screws (2) and fairing (1).

(6) Remove bolts (3) and inner duct segment (4).

(7) Remove lockwire and loosen coupling nuts (19).

(8) Remove transfer tubes (18) and discard preformed packings (17). Cap all exposed openings.



Primary Fuel Tube Assembly - Removal/Installation
Figure 201

Key to Figure 201

1. Preformed Packing
2. Transfer Tube
3. Coupling Nut
4. Self-locking Nut
5. Loop Clamp
6. Primary Fuel Tube Assembly
7. Bolt
8. Preformed Packing
9. Preformed Packing
10. Angle Bracket (Ref.)
11. Bolt
12. Primary Fuel Nozzle (Ref.)
13. Bolt (Post-SB24331)
14. Nut (Post-SB24331)
15. Loop Clamp (Post-SB24331) (Ref. Installed on No. 4 Bearing Scavenge Tube)

(9) Remove three bolts (13) and three retaining plates (14) and push back three outer tubes (11).

(10) Remove two bolts (15) and remove two primary fuel nozzles (12).

(11) Discard gaskets (16) and preformed packings (8 and 9).

B. Installation (Ref. Fig. 202)

(1) Install new preformed packings (8) on fuel nozzles (12).

(2) Install new preformed packings (9) on inner fuel tubes (10).

(3) Slide one outer fuel tube (11) on fuel manifold. Slide remaining two outer fuel tubes on fuel nozzles (12).

(4) Install new gasket (16) on fuel nozzles and insert nozzles into bosses in combustor outer case.

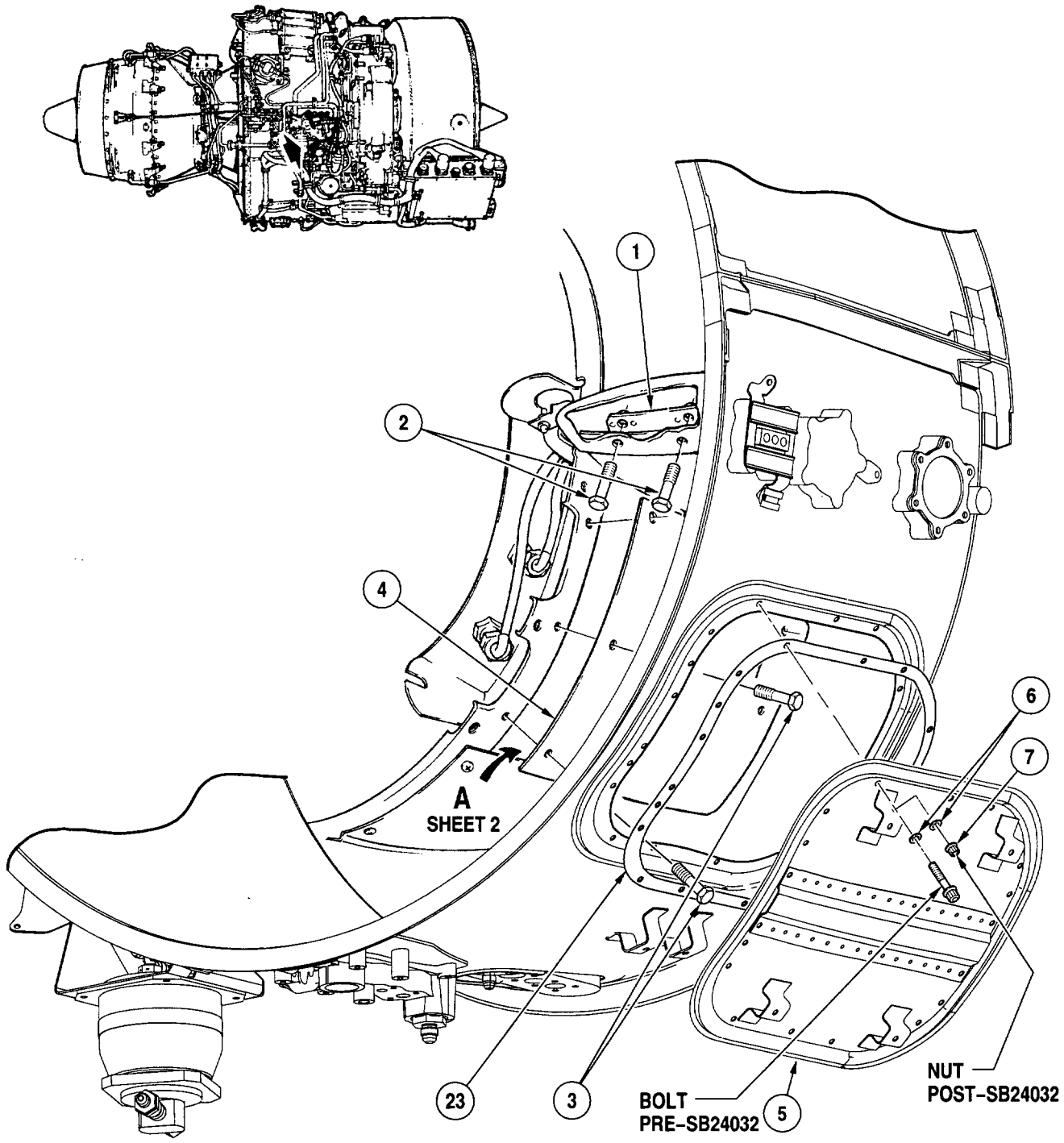
(5) Secure each fuel nozzle with one bolt (15), fingertight.

(6) Connect fuel nozzles with fuel manifold by sliding outer fuel tubes (11) into place.

(7) Install outer fuel tubes in place with three retaining plates (14) and bolts (13), fingertight.

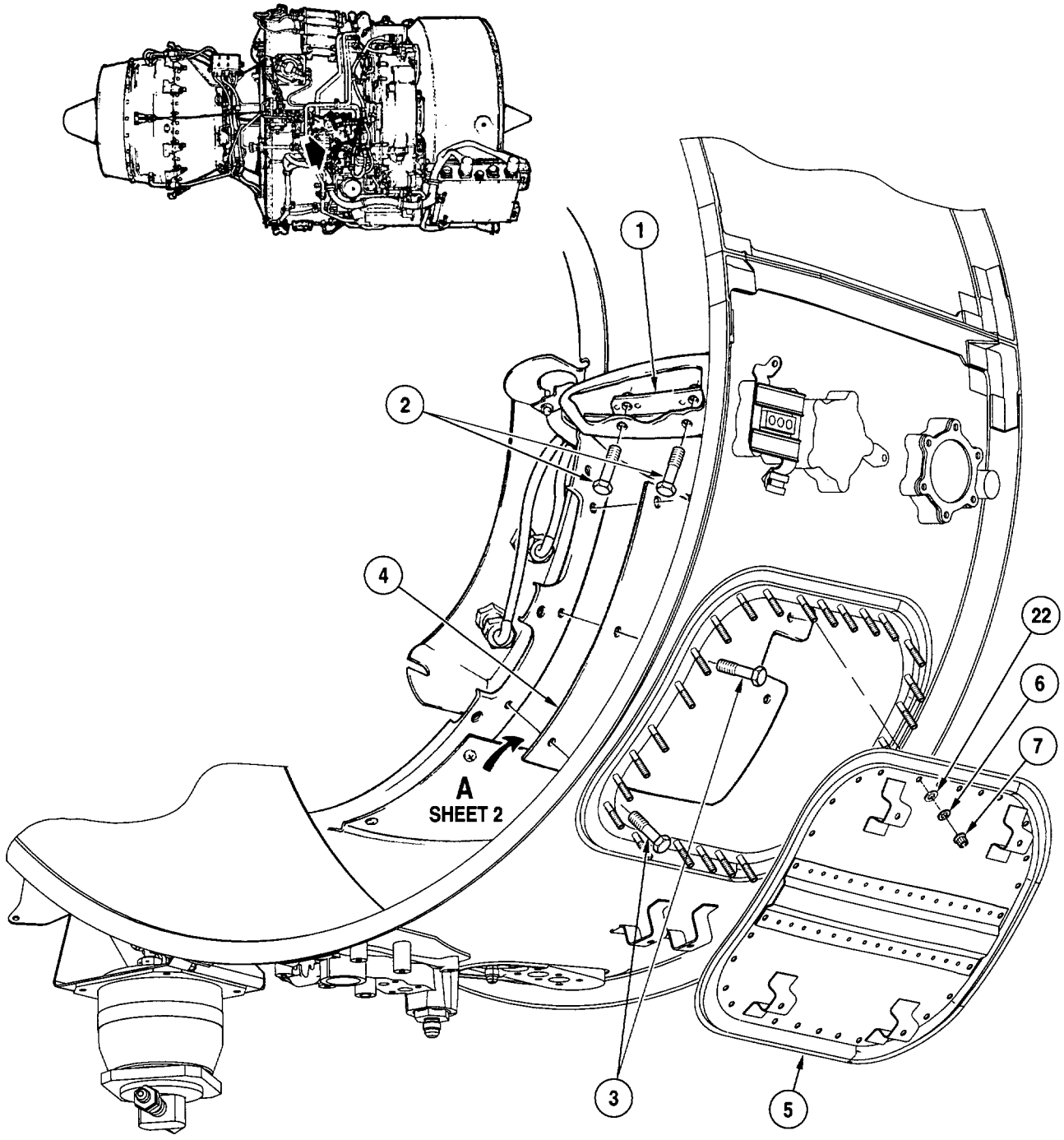
(8) Tighten bolts (13 and 15) 36 to 40 lb.in. (4.1-4.5 Nm).

(9) Install new preformed packings (17) on transfer tubes (18) and install transfer tubes in fuel nozzles.



Post SB24177/Pre SB24344 C100911A

Primary Fuel Manifold and Nozzles - Removal/Installation
Figure 202 (Sheet 1 of 3)



Post SB24344

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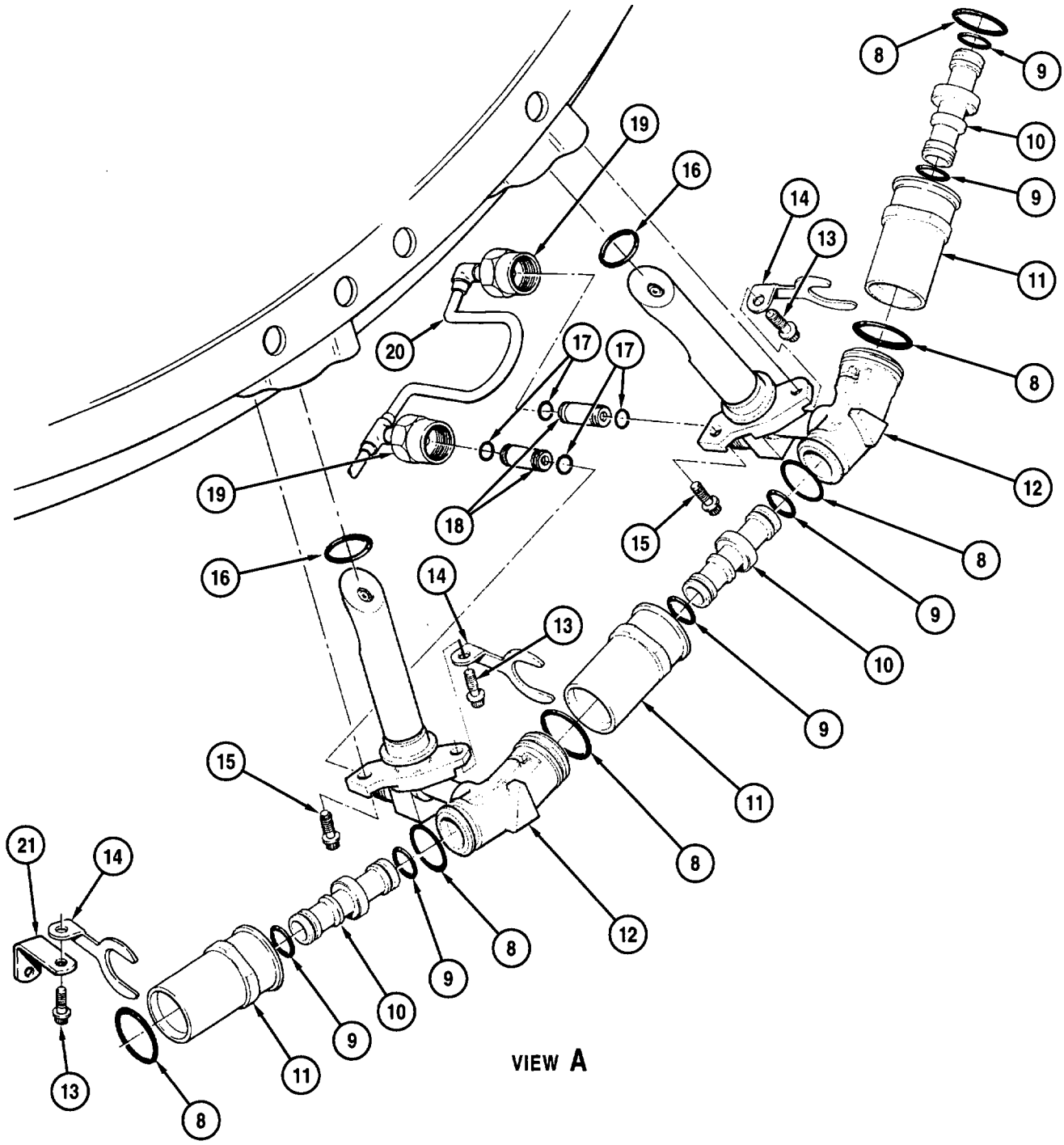
Primary Fuel Manifold and Nozzles - Removal/Installation
Figure 202 (Sheet 2)

Key to Figure 202

1. Fairing
2. Bolt
3. Bolt
4. Inner Duct Segment
5. Outer Cover
6. Washer
7. Bolt (Pre-SB24032)
7. Nut (Post-SB24032)
8. Preformed Packing
9. Preformed Packing
10. Inner Fuel Tube
11. Outer Fuel Tube
12. Primary Fuel Nozzle
13. Bolt
14. Retaining Plate
15. Bolt
16. Gasket
17. Preformed Packing
18. Transfer Tube
19. Coupling Nut
20. Primary Fuel Tube Assembly
21. Angle Bracket
22. Gasket (Post-SB24344)
23. Gasket (Post-SB24177)



Primary Fuel Manifold and Nozzles - Removal/Installation
Figure 202 (Sheet 3)

CAUTION: MAKE SURE THE ANTI-SEIZE COMPOUND MIXTURE WILL NOT PENETRATE THE FUEL PASSAGE OF THE PRIMARY NOZZLE.

(10) Lubricate threads of coupling nuts (19) with mixture of 20% engine oil (PWC03-001) and 80% anti-seize compound (PWC06-004A).

(11) Secure two coupling nuts (19) to two primary fuel nozzles (12). Tighten each coupling nut 225 to 250 lb.in. (25-28 Nm) and install lockwire.

(12) Install fairing (1) with bolts (2). Tighten 36 to 40 lb.in. (4.0-4.5 Nm).

(13) Install inner duct segment (4) with bolts (3). Tighten 36 to 40 lb.in. (4.0-4.5 Nm).

(14) Post-SB24177/Pre-SB24344: Install outer cover (5), gasket (23), washers (6) and nuts (7). Tighten nuts 23 to 26 lb.in (2.6-2.9 Nm).

(15) Post-SB24344: Install outer cover (5), gaskets (22), washers (6) and nuts (7). Make sure gaskets are between duct and washers. Tighten nuts 23 to 26 lb.in (2.6-2.9 Nm) in a star pattern from top center of cover outward.

(16) Refer to Chapter 71-00-00, ADJUSTMENT/TEST, for required checks following installation of fuel nozzles.

7. Secondary Fuel Manifold and Nozzles

CAUTION: EXTREME CARE MUST BE EXERCISED WHEN HANDLING FUEL NOZZLE ASSEMBLIES. FINGERPRINTS ON THE ORIFICE MAY PRODUCE POOR SPRAY PATTERN. CLEAN, LINT-FREE COTTON GLOVES OR SURGICAL GLOVES SHOULD BE WORN AT ALL TIMES WHEN HANDLING IS REQUIRED.

CAUTION: REPLACEMENT FUEL NOZZLES MUST BE FROM THE SAME MANUFACTURER AS ONE REMOVED.

A. Removal (Ref. Fig. 202 and 203)

(1) Remove upper segments of outer bypass duct (Ref. Chapter 72-70-01)

(2) Remove inner bypass ducts (Ref. Chapter 72-70-01)

(3) Remove 21 bolts (8, Fig. 203) and tube retaining plates (9).

(4) Slide 21 fuel manifold tube assemblies (6) back, to disengage from adjacent fuel nozzle.

(5) Remove three bolts (10) and three fuel nozzles (2) 120 degrees apart, and install three locators (PWC61148).

(6) Remove one bolt (10) and fuel inlet nozzle (1).

(7) Remove remaining 20 bolts (10) and fuel nozzles (2). Completely remove one nozzle before proceeding to the next.

(8) Remove and discard 22 metal gaskets (11) from 21 fuel nozzles (2) and one fuel inlet nozzle (1).

(9) Remove 22 fuel manifold tube assemblies (6) from fuel nozzles and fuel inlet nozzle.

(10) Remove and discard 44 preformed packings (3) from fuel nozzles and fuel inlet nozzle.

(11) Remove 22 inner fuel manifold tubes (5) from 22 outer fuel manifold tubes (7). Remove and discard 44 preformed packings (4).

(12) Remove inner and outer manifold tubes (10 and 11, Fig. 202) from adjacent primary nozzles.

(13) Remove and discard preformed packings (9).

(14) Remove primary manifold and nozzles (Ref. Subpara. A.).

(15) Place closures over all openings of fuel nozzles and fuel inlet nozzle and place in individual containers.

B. Installation (Ref. Figs. 202 and 203)

(1) Lubricate preformed packings (4, Fig. 203) with engine oil (PWC03-001) and install on 21 inner fuel manifold tubes (5).

(2) Lubricate preformed packings (9, Fig. 202) with engine oil (PWC03-001) and install on one inner fuel manifold tube (10).

(3) Introduce one inner manifold tube (10), with side having an extra shoulder, into one outer manifold tube (11), through end with flats. Thread inner manifold tube (10) into outer manifold tube (11) until threaded shoulder on inner tube is trapped between shoulders on outer tube.

(4) Introduce inner manifold tubes (5, Fig. 203) with side having an extra shoulder, into outer manifold tubes (7) through end with flats. Thread inner manifold tube (5) into outer manifold tube (7) until threaded shoulder on inner tube is trapped between shoulder on outer tube.

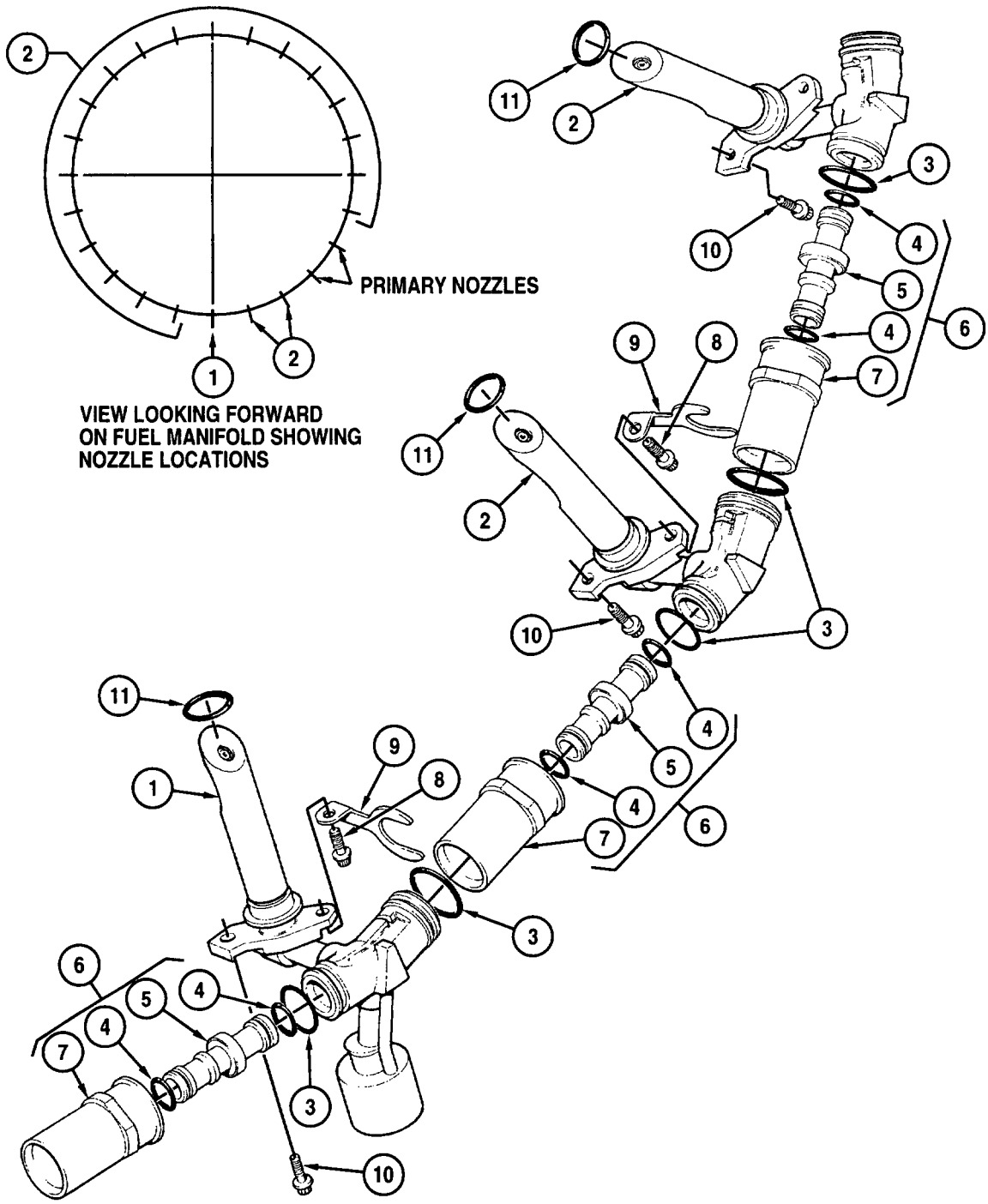
(5) Lubricate preformed packings (3) with engine oil (PWC03-001) and install on inlet nozzle (1).

(6) Lubricate remaining preformed packings (3) with engine oil (PWC03-001) and install on fuel nozzles (2).

(7) Lubricate preformed packing (8, Fig. 202) with engine oil (PWC03-001) and install on one fuel nozzle (2, Fig. 203)

(8) Insert outer fuel tube assembly (11, Fig. 202) into one fuel nozzle (2, Fig. 203).

NOTE: Insert end of tube assembly without flats, into grooved end of fuel nozzle.



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Secondary Fuel Manifold and Nozzles - Removal/Installation
Figure 203

Key to Figure 203

1. Fuel Inlet Nozzle
2. Fuel Nozzle (Secondary)
3. Preformed Packing
4. Preformed Packing
5. Fuel Manifold Tube (Inner)
6. Fuel Manifold Tube Assembly
7. Fuel Manifold Tube (Outer)
8. Bolt
9. Tube Retaining Plate
10. Bolt
11. Metal Gasket

(9) Insert fuel manifold tube assemblies, (6, Fig. 203) into fuel nozzles (2) and one primary fuel nozzle (1).

NOTE: Insert end of tube assembly without flats, into grooved end of fuel nozzle.

(10) Install metal gaskets (11) on 21 fuel nozzles (2) and one fuel inlet nozzle (1).

(11) Insert fuel inlet nozzle (1) in combustion chamber outer case assembly, at bottom centre location. Make sure nozzle enters combustion chamber. Install bolt (10) fingertight.

(12) Insert fuel nozzle assemblies (2) in combustion chamber outer case assembly, leaving two open bosses for primary fuel nozzles (Ref. View looking forward on fuel manifold). Install bolts (10) fingertight.

(13) Slide fuel manifold tube assemblies (6) over fuel nozzles until retaining plate locking grooves are exposed.

(14) Insert one tube retaining plate (9) into locking groove of fuel inlet nozzle (1). Install bolt (8) fingertight.

(15) Insert tube retaining plates (9) into locking grooves in fuel nozzles (2) with bolts (8) fingertight.

(16) Install primary manifold and fuel nozzles (Ref. Subpara B.).

(17) Tighten bolts (8 and 10) 36 to 40 lb.in. (4.0-4.6 Nm).

(18) Install inner bypass duct (Ref. Chapter 72-70-01).

(19) Install upper segments of outer bypass duct (Ref. Chapter 72-70-01).

(20) Refer to Chapter 71-00-00 for checks required following installation of fuel manifold and nozzles.

8. Cleaning/Painting

A. Cleaning of Fuel Nozzles

(1) Return fuel nozzles to Pratt & Whitney Canada or Delavan Incorporation USA for cleaning and inspection. Send nozzles to:

Pratt & Whitney Canada Corp.
1000 Marie-Victorin Blvd.
Longueuil, Quebec
Canada J4G 1A1
or

Delavan Inc.
811, 4th Street
West Des Moines, IA 50265 - 5370
USA

9. Inspection/Check

A. Inlet Fuel Nozzle

(1) DELETED

B. Primary Fuel Nozzles

(1) DELETED

C. Secondary Fuel Nozzles

(1) DELETED

10. Adjustment/Test

A. Fuel Manifold Assembly Pressure Test (Ref. Fig. 204)

NOTE: This procedure is used on fuel manifolds installed on a combustor prior to installation on the engine.

(1) Install plug (PWC60712) (1) in main fuel passage of fuel inlet nozzle (2).

(2) Install inlet adaptor (PWC60711) (3) in fuel inlet nozzle (2) and lock in place using locking clamp (PWC60710) (4).

(3) Connect pressure test kit (PWC60718) to inlet adaptor (3).

(4) Make sure test kit selector valve (6) is set in the OFF/TEST position.

(5) Make sure pressure regulator valve (7) is closed (if regulator is not preset).

(6) Open the shut off valve on the nitrogen cylinder (PWC05-050).

(7) Adjust pressure regulator valve (7) until pressure is 100 to 150 psi (689.4-1034.2 kPa), if regulator is not preset.

(8) Turn selector valve (6) to the COMBUSTOR position.

(9) Make sure test kit pressure is 100 to 150 psi (689.4-1034.2 kPa).

(10) Turn selector valve (6) to the OFF /TEST position.

(11) Close the shut off valve on nitrogen cylinder.

CAUTION: NO DECREASE IN PRESSURE IS PERMITTED.

(12) Monitor test kit pressure gauge for 5 minutes minimum.

(a) If there is no decrease in pressure, go to step (13).

(b) If there is a decrease in pressure proceed as follows:

1 Find the source of the leak.

2 Repair the leak.

3 Pressure test fuel manifold assembly Ref. Para. A..

(13) Turn selector valve (6) to BLEED OFF position.

(14) Close pressure adjusting valve (7) on nitrogen cylinder (if regulator is not preset).

(15) Remove clamp (4), test adapter (3), plug (1) and test kit (5).

B. Fuel Manifold Pressure Test - Combustor Installed on Engine (Ref. Fig. 205)

NOTE: This procedure is used on an installed engine; eg: after HSI or changing primary fuel nozzles.

(1) Disconnect the nacelle drain line from drain adapter (1), (Ref. Aircraft Maintenance Manual).

(2) Connect hose assembly (6) of leak check fixture (PWC61792) (5) to drain adaptor (1).

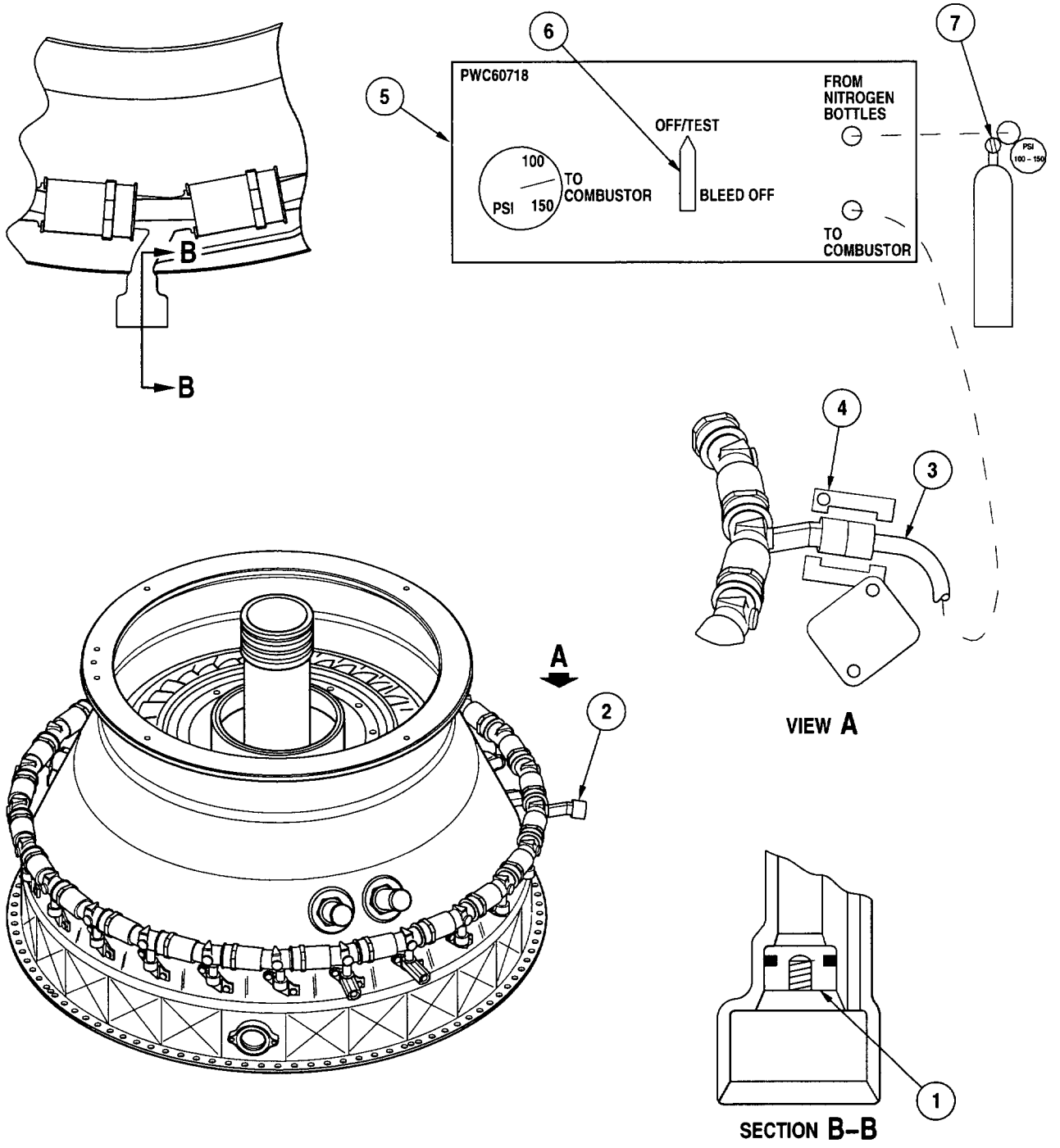
(3) Make sure test kit selector valve (3) is set in the OFF /TEST position.

(4) Make sure the regulator valve on cylinder (2) containing nitrogen (PWC05-050) is closed.

(5) Open the shut off valve on nitrogen cylinder (2).

(6) Adjust pressure regulator valve on cylinder (2) until pressure is 100 to 150 psi (689.4-1034.2 kPa).

(7) Turn selector valve (3) to the TO COMBUSTOR position.



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Fuel Manifold - Pressure Test
Figure 204

Key to Figure 204

1. Plug
2. Fuel Inlet Nozzle
3. Inlet Adaptor
4. Locking Clamp
5. Test Kit
6. Selector Valve
7. Nitrogen Pressure Regulator

(8) Make sure gauge (4) reads 100 to 150 psi (689.4-1034.2 kPa).

(9) Turn selector valve (3) to the OFF /TEST position.

(10) Close the shut off valve on nitrogen cylinder (2).

CAUTION: NO DECREASE IN PRESSURE IS PERMITTED.

(11) Monitor test kit pressure gauge (4) for 5 minutes minimum.

(a) If there is no decrease in pressure, go to step (12).

(b) If there is a decrease in pressure proceed as follows:

1 Find the source of the leak.

2 Repair the leak.

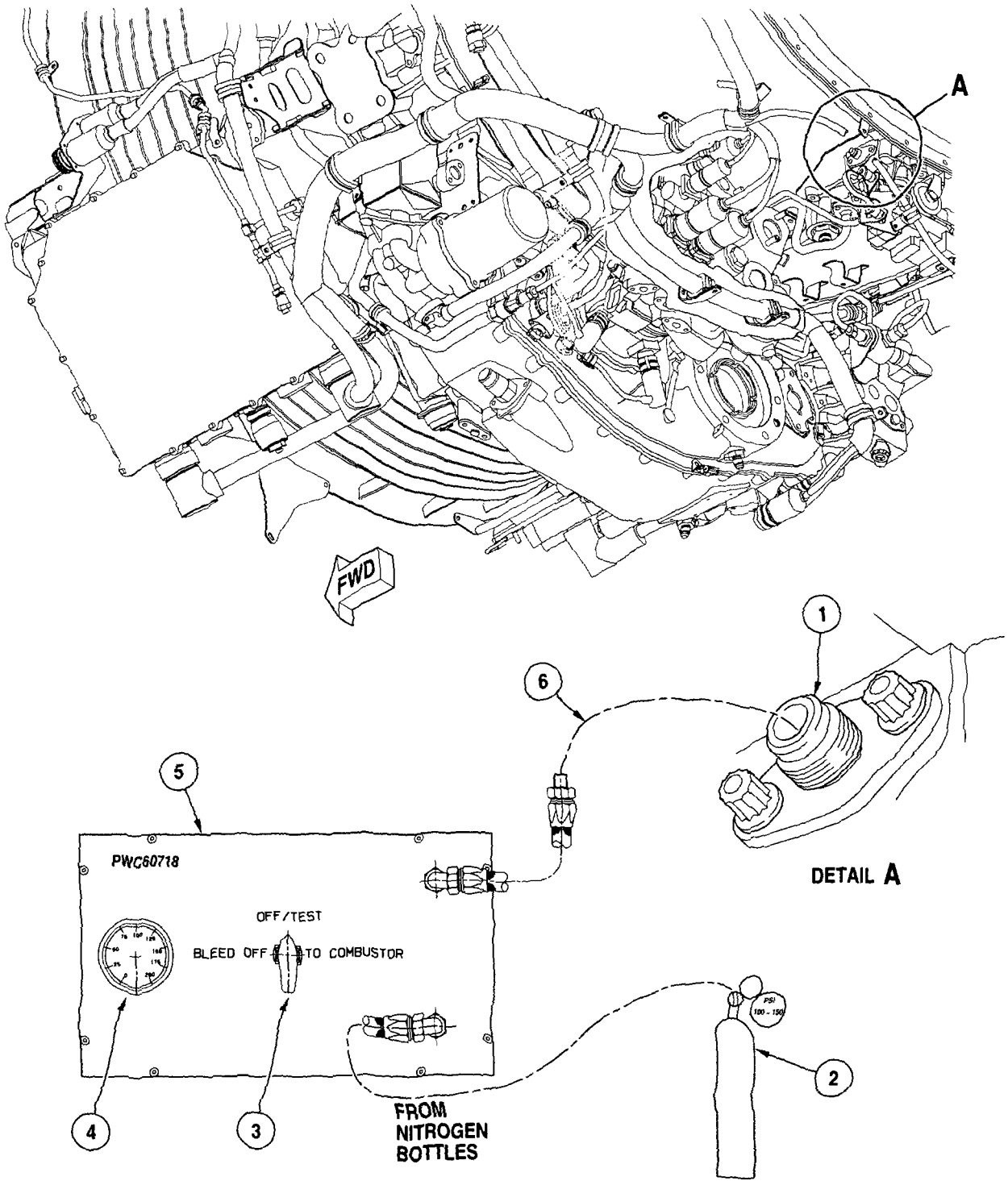
3 Pressure test fuel manifold assembly (Ref. Para. A. and/or B.).

(12) Turn selector valve (3) to BLEED OFF position.

(13) Close pressure adjusting valve on nitrogen cylinder (2).

(14) Remove hose assembly (6) from drain adapter (1).

(15) Connect the nacelle drain line to drain adapter (1), (Ref. Aircraft Maintenance Manual).



Fuel Manifold Pressure Test
Figure 205

Key to Figure 205

1. Drain Adapter
2. Nitrogen Cylinder
3. Selector Valve
4. Pressure Gauge
5. Leak Check Fixture
6. Hose Assembly

FUEL SHUTOFF AND DRAIN - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are identified in procedural text.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-089	Lockwire
PWC05-344	Safety Cable

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC60142-100	Wrench

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Fuel Dump Valve (Pre-SB24156) or Start Fuel and Dump Valve (PW305A or Post-SB24156)

   A. Removal (Ref. Fig. 201)

      (1) Select maintenance discrete ON (PW305A or Post-SB24156).

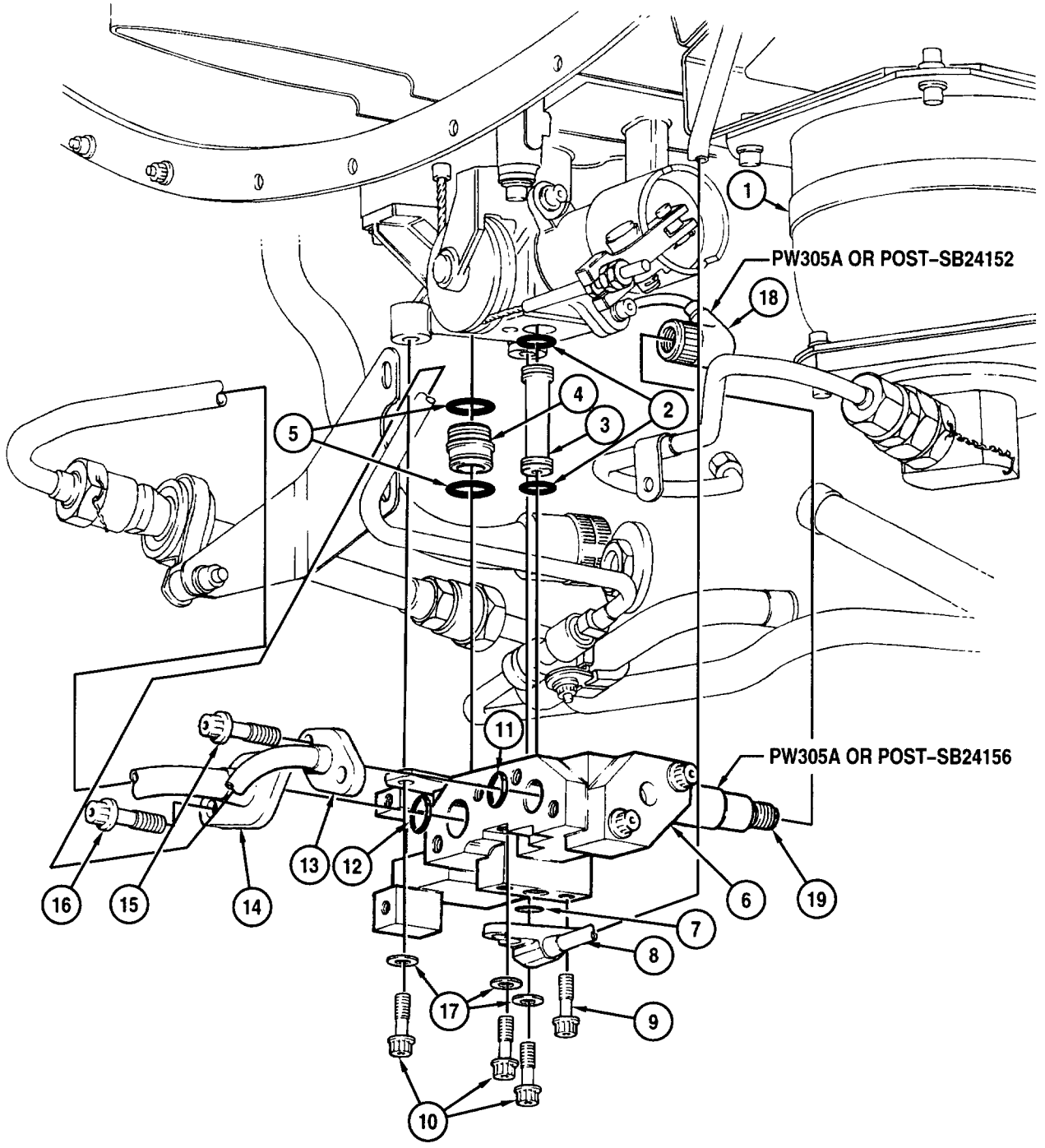
      (2) Remove P34 connector (17) (PW305A or Post-SB24156).

      (3) Remove two bolts (9) from transfer tube (8) connecting dump valve (6) to fuel waste ejector (1). Discard preformed packing (7).

      (4) Remove bolts (15) and move tubes (13 and 14) away from dump valve. Remove and discard preformed packings (11 and 12).

      (5) Remove three bolts (10) and three washers (17) securing dump valve to fuel shut-off valve and remove dump valve.

      (6) Remove transfer tubes (3 and 4) from dump valve (6). Remove and discard preformed packings (2 and 5).



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Fuel Dump Valve - Removal/Installation
Figure 201

Key to Figure 201

1. Fuel Waste Ejector
2. Preformed Packing
3. Transfer Tube
4. Transfer Tube
5. Preformed Packing
6. Fuel Dump Valve
7. Preformed Packing
8. Fuel Tube Assy (Dump Valve to Waste Ejector)
9. Bolt
10. Bolt
11. Preformed Packing
12. Preformed Packing
13. Fuel Tube (Primary Supply)
14. Fuel Tube (Secondary Supply)
15. Bolt
16. Bolt
17. Washer
18. P34 Connector (PW305A or Post-SB24156)
19. Start Valve (PW305A or Post-SB24156)

(7) Plug/cap all openings.

B. Installation (Ref. Fig. 201)

(1) Lubricate new preformed packings (2 and 5) with engine oil (PWC03-001), and install on transfer tubes (3 and 4). Insert transfer tubes (3 and 4) into fuel dump valve (6).

(2) Insert fuel dump valve into fuel shut-off valve, ensuring transfer tubes (3 and 4) are properly seated.

(3) Secure fuel dump valve to fuel shut-off valve with three bolts (10) and three washers (17). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm).

(4) Lubricate new preformed packings with engine oil (PWC03-001) and install on tubes (8, 13 and 14). Fit tubes in place and secure tube to fuel dump valve with bolts (9 and 15). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm).

(5) PW305A or Post-SB24156: Install P34 connector (18) to start fuel valve (19). Torque connector 24 to 29 lb.in. (2.7-3.2 Nm) using wrench (PWC60142-100).

(6) Post-SB24372: Apply electrical insulation tape to connector (Ref. 70-00-00, REMOVAL/INSTALLATION).

(7) Perform following check after start/dump valve installation (PW305A or Post-SB24156):

(a) Restore electrical power to appropriate system and reset EEC power ON.

(b) Select TLA to idle detent position.

(c) Disconnect start/dump valve connector P34.

(d) Check white fault lamp illuminates at cockpit isolation panel and MFD Code WA is annunciated.

(e) Pull EEC circuit breaker to OFF.

(f) Select maintenance test discrete ON.

(g) Re-install connector P34 (18) to start fuel valve (19). Torque connector 24 to 29 lb.in. (2.7-3.2 Nm) using wrench (PWC60142-100).

(h) Reset EEC circuit breaker ON.

(i) Select maintenance test discrete OFF.

(8) Pull EEC circuit breaker OFF.

(9) Function check the dump valve (Ref Subpara C. following).

C. Functional Check (Ref. Fig. 201)

(1) Remove two bolts (9) from transfer tube (8) connecting dump valve (6) to fuel waste ejector (1). Discard preformed packing (7).

(2) Remove transfer tube (8) from fuel waste ejector (Ref. 73-10-03).

(3) Fit suitable slave fitting to the dump valve outlet and connect fitting to a large vented drain bottle.

(4) Wet motor engine (Ref. 71-00-00) and check that fuel does not leak from the dump valve during motoring cycle.

(5) Continuous dripping of fuel from the dump valve during a wet motoring cycle indicates a defective valve.

(6) After motoring cycle, make sure dump valve drains residual fuel to the drain bottle.

(7) If fuel does not drain, replace dump valve.

(8) Remove slave fitting and drain bottle.

(9) Lubricate new preformed packings with clean engine oil (PWC03-001) and install on tube (8). Fit tube in place and secure to fuel dump valve with bolts (9 and 15). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm). Refer to (Ref. 73-10-03) for connection to fuel waste ejector.

(10) Restore engine to standard operating conditions.

6. Fuel shut-off Valve

A. Removal (Ref. Fig. 202)

(1) Remove fuel dump valve (Ref. Para. 5. A.).

(2) Pre-SB24513: Remove lockwire, seal and loosen nuts (10 and 11). Remove fuel shut-off cable (8) from fuel shut-off valve control lever.

(3) Post-SB24513: Remove safety cable, seal and loosen nuts (10 and 11). Remove fuel shut-off cable (8) from fuel shut-off valve control lever.

(4) Remove bolts (13) and flat washers (12). Pull fuel shut-off valve (7) away from mounting pad and discard preformed packings (6).

(5) Remove transfer tubes (2 and 4) and discard preformed packings (1, 3 and 5).

(6) Plug/cap all openings.

B. Installation (Ref. Fig. 202)

(1) Lubricate two new preformed packings (6) with engine oil (PWC03-001), and install on fuel shut-off valve (7).

(2) Lubricate new preformed packings (1, 3 and 5) with engine oil (PWC03-001), and install on transfer tubes (2 and 4). Insert transfer tubes into fuel shut-off valve.

(3) Install fuel shut-off valve on mounting pad of bypass duct, being careful to insert transfer tubes (2 and 4) into fuel inlet nozzle. Install four bolts (13) and washers (12). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm).

(4) Install fuel dump valve (Ref. Para.5. B.).

(5) Attach fuel shut-off cable (8) to fuel shut-off valve control lever and check adjustment.

C. Resetting Procedure (Ref. Fig. 204)

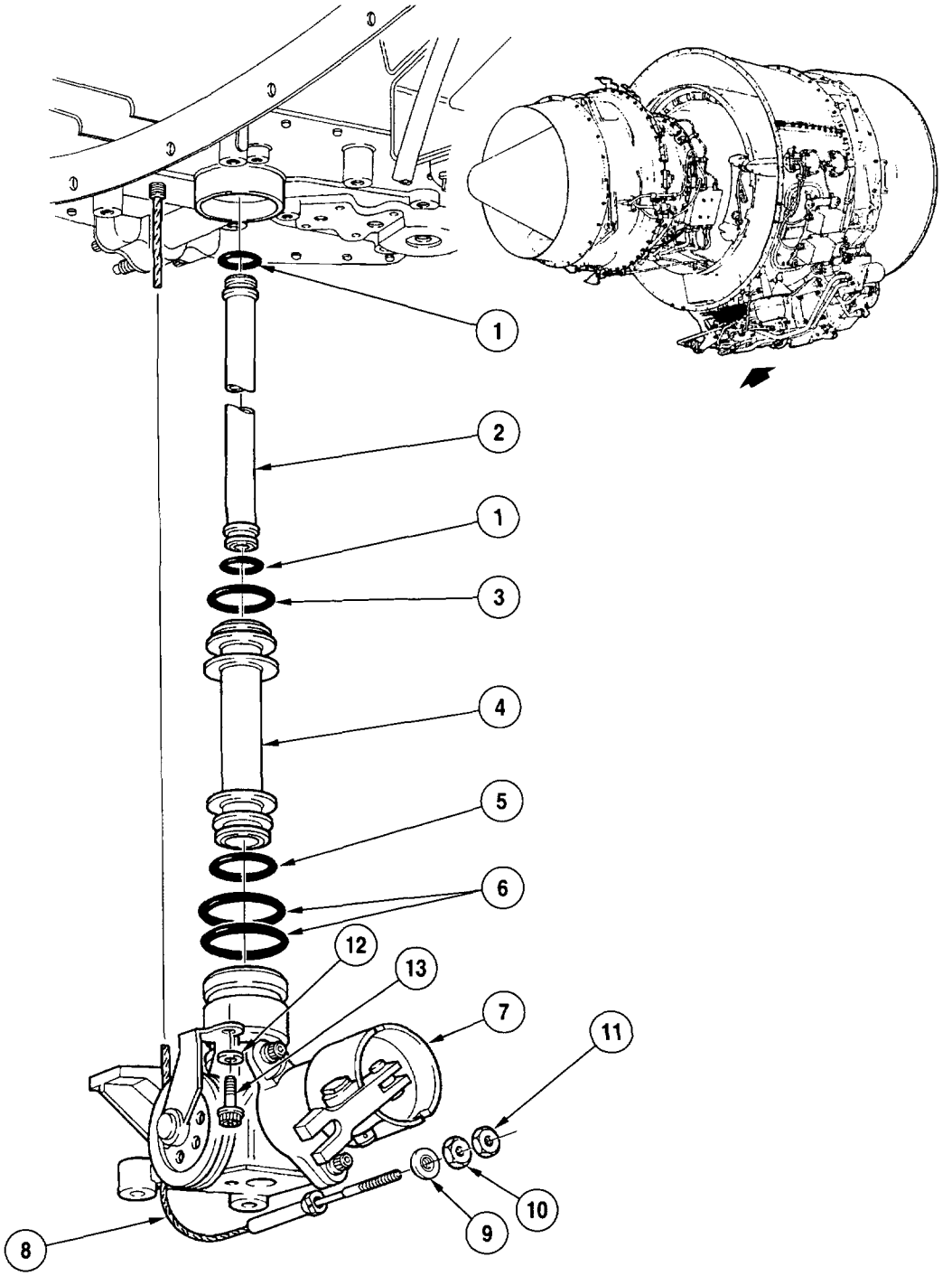
(1) Pre-SB24513: Remove lockwire, seal, nuts (4) and spacer (3) that attaches the fuel shut-off cable (2) to control lever (8).

(2) Post-SB24513: Remove safety cable, seal, nuts (4) and spacer (3) that attaches the fuel shut-off cable (2) to control lever (8).

(3) Remove two bolts (6), washers (5) and remove overspeed control linkage housing (7) from fuel inlet and shut-off valve housing (1). Ensure release plate (9) does not fall from assembly.

(4) Push control lever (8) to slightly withdraw tripper sleeve assembly (15), thus allowing control levers (13) to pivot freely.

(5) Adjust control levers (13), using a soft-faced tool, to centralize with hole in tripper sleeve assembly (15).



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Fuel shut-off Valve - Removal/Installation
Figure 202

Key to Figure 202

1. Preformed Packing
2. Transfer Tube
3. Preformed Packing
4. Transfer Tube
5. Preformed Packing
6. Preformed Packing
7. Fuel shut-off Valve
8. Emergency Fuel shut-off Cable
9. Spacer
10. Nut
11. Nut
12. Washer
13. Bolt

(6) Release pressure from control lever (8). Tripper sleeve (15) will snap into place if control levers (13) are centralized. Repeat steps (3) and (4), if necessary, until levers are reset.

CAUTION: DO NOT HAMMER FUEL SHUT-OFF VALVE TRIPPER SLEEVE.

(7) Using a soft drift apply even pressure on tripper sleeve to make sure sleeve is fully seated.

(8) Insert narrow end of release plate (9) between control levers (13) so that head of release plate contacts end of piston assembly in fuel inlet and shut-off valve assembly (1).

(9) Fuel shut-off valve is now reset.

(10) Measure Dimension AA between lug on tripper sleeve assembly (15) and rear face of control linkage housing (7). This dimension is used when installing the fuel shut-off cable.

(11) Install control linkage housing (7) on fuel inlet and shut-off valve housing (1) with two bolts (6) and washers (5). Torque 36 to 40 lb.in. (4.0-4.5 Nm).

(12) Adjust emergency fuel shut-off cable (Ref. Para. 7.).

(13) Pre-SB24513: Install lockwire (PWC05-089) and seal between nuts (4).

(14) Post-SB24513: Install safety cable (PWC05-344) and seal between nuts (4).

D. Visual Inspection

(1) Visually inspect the cable mechanism for corrosion.

(2) Borescope the cable mechanism in the exhaust case.

(a) Check for corrosion and security.

(b) Check the plunger assembly for any leakage from the oil seal.

(3) Visually inspect the fuel shut off mechanism for corrosion.

(4) Check for correct setting (Ref. Para E.).

E. Periodic Inspection (Ref. Fig. 204)

NOTE: Refer to Ch. 05-20-00, Periodic Inspection for inspection intervals.

(1) Measure emergency fuel shut-off tripper Dim. T and record.

CAUTION: DO NOT HAMMER FUEL SHUT-OFF VALVE TRIPPER SLEEVE.

(2) Using a soft drift apply even pressure on tripper sleeve (15) to make sure sleeve is fully seated.

(3) Measure emergency fuel shut-off tripper Dim. T. Re-rig if Dim. T is less than 0.008 inch.

(4) Do Engine Ground Checks No. 1 and No. 2 (Ref. Ch. 71-00-00).

(5) Advance TLA to normal take-off detent. Hold in this position for as long as possible for a maximum of two minutes. Move TLA to ground idle to allow engine to stabilize.

(6) Shut engine down per Check No. 3 (Ref. Ch. 71-00-00).

(7) Check for security and leakage.

7. Emergency Fuel Shut-off Cable

A. Removal (Ref. Fig. 203)

CAUTION: DO NOT CAUSE FUEL SHUT-OFF MECHANISM TO TRIP BY LETTING THE CONTROL LEVER MOVE OUT.

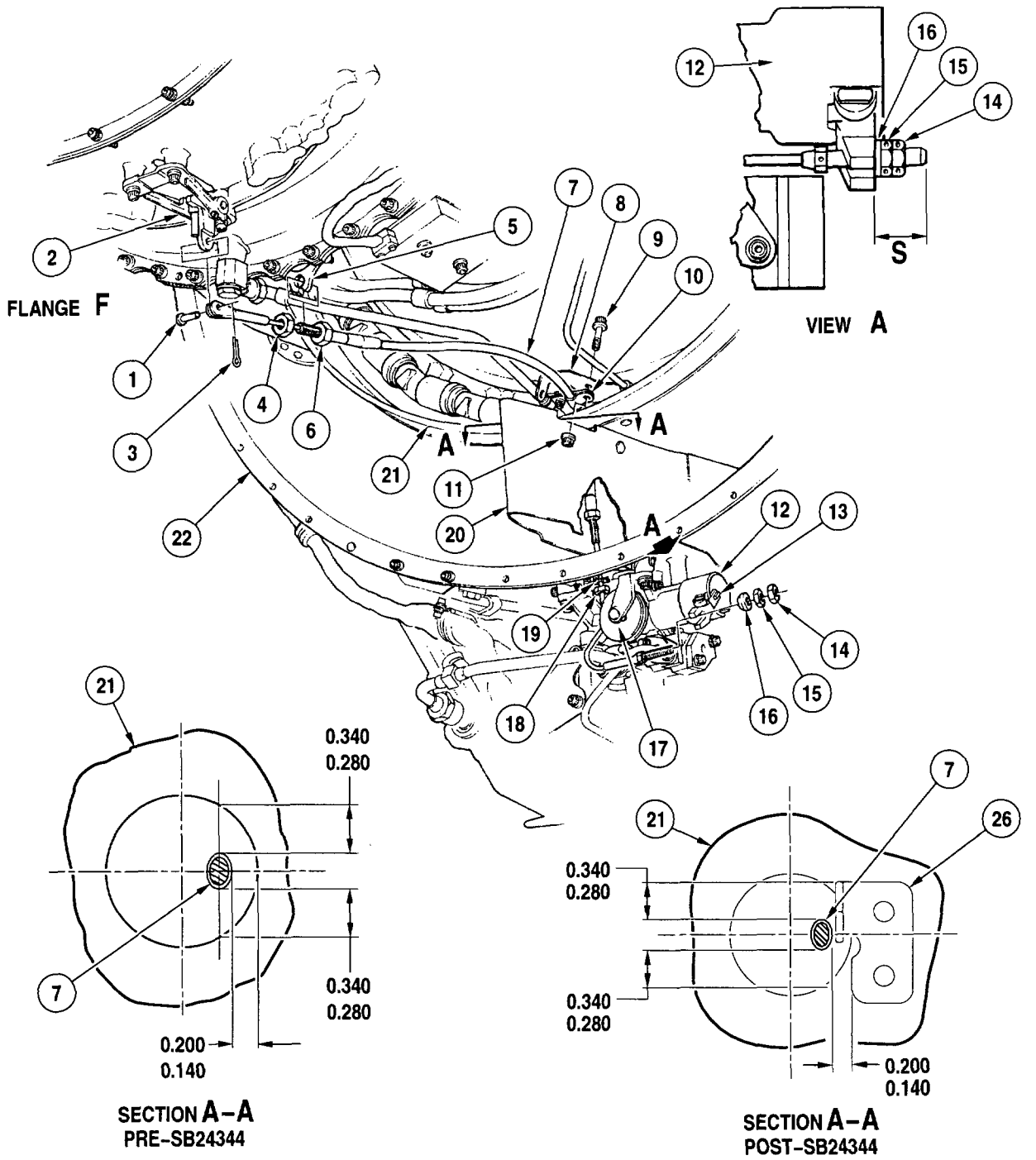
(1) Carefully remove lockwire, lead seal, nuts (14, 15) and spacer (16) from the lower end of control cable (7).

(2) Remove cable end from control lever.

(3) Remove cotterpin (3), pin (1) and cable end from bellcrank (2). Discard cotterpin (3).

(4) Move bellcrank (2) to forward position and secure to exhaust case with lockwire (PWC05-089).

NOTE: This will prevent disengagement of cable from actuating lever inside exhaust case.



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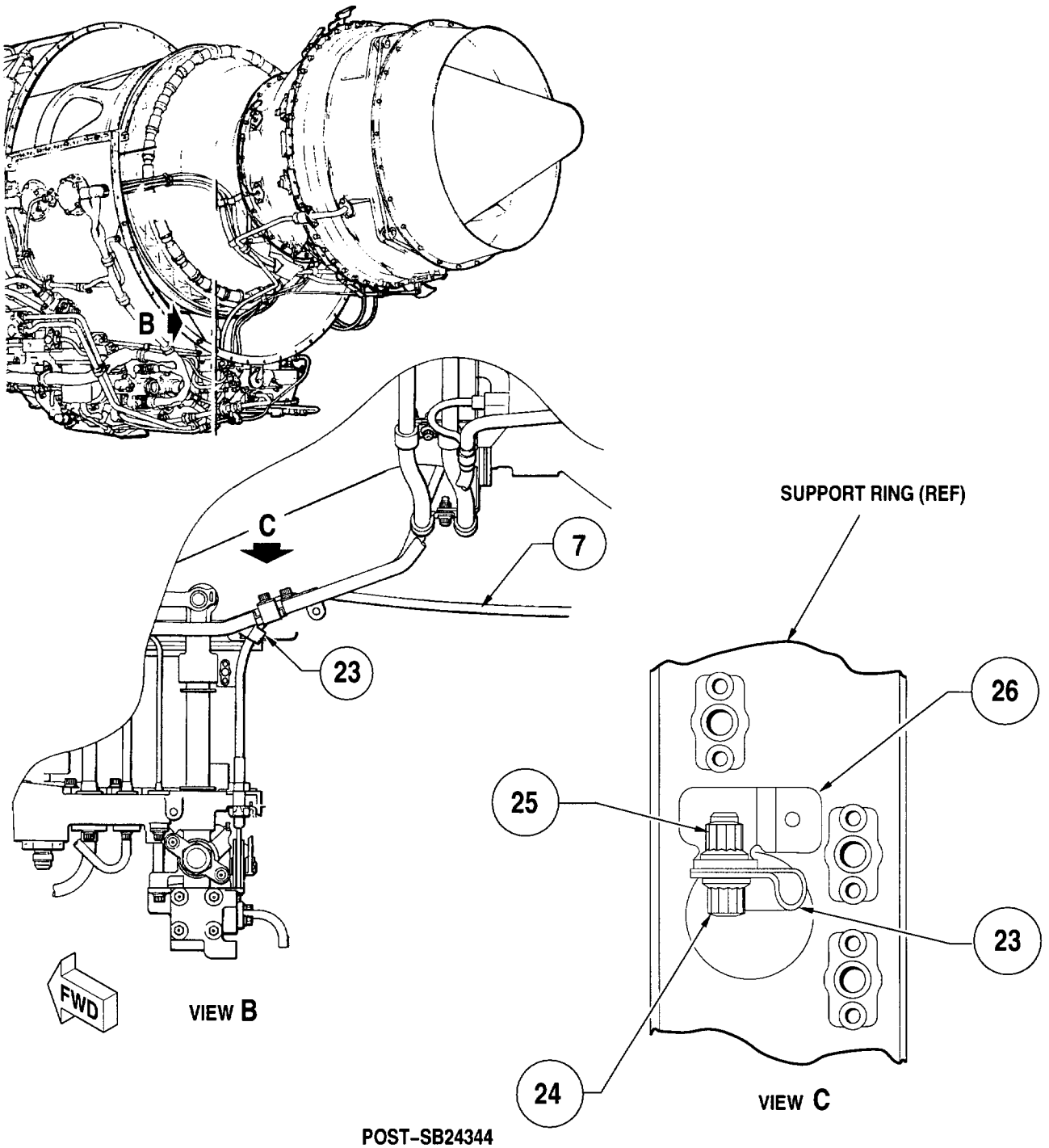
Emergency Fuel Shut-off Cable - Removal/Installation
Figure 203 (Sheet 1 of 2)



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Emergency Fuel Shut-off Cable - Removal/Installation
Figure 203 (Sheet 2)

Key to Figure 203

1. Pin
2. Bell Crank
3. Cotterpin
4. Nut
5. Bracket
6. Nut
7. Fuel Shut-off Cable Assembly
8. Bracket
9. Bolt
10. Clamp
11. Nut
12. Fuel Shut-off Valve
13. Control Lever
14. Nut
15. Nut
16. Spacer
17. Pulley
18. Nut
19. Keywasher
20. Fairing
21. Inner Bypass Duct
22. Outer Bypass Duct
23. Loop clamp (Post-SB24344)
24. Nut (Post-SB24344)
25. Bolt (Post-SB24344)
26. Bracket (Post-SB24344)

(5) Unlock keywasher (19) and remove with nut (18). Discard key washer.

(6) Remove nut (11), bolt (9) and clamp (10).

(7) Post-SB24344: Remove nut (24), bolt (25) and clamp (23) from bracket (26).

(8) Remove lockwire and loosen nut (4).

(9) Remove fuel shut-off cable from engine by pulling upwards through fairing of bypass duct (22).

B. Installation (Ref. Fig. 203)

(1) If lower end of cable assembly (7) was not removed from bypass duct (22) or fuel shut-off valve control lever (13) go to step (5).

(2) Put the threaded end of cable assembly (7) through holes at bottom of inner and outer bypass ducts (21, 22).

(3) Install housing end of cable assembly on outer bypass duct with keywasher (19) and nut (18). Torque nut 62 to 85 lb. in. (7.0-9.5 Nm.). Bend tabs on keywasher to lock nut.

CAUTION: DO NOT CAUSE FUEL SHUT-OFF MECHANISM TO TRIP BY LETTING THE CONTROL LEVER MOVE OUT.

(4) Engage cable with pulley (17) of fuel shut-off valve and connect end of cable to control lever (13) with spacer (16) and nuts (15, 14), finger tight.

(5) Install cable assembly (7) loosely to bracket (8) with clamp (10), nut (11) and bolt (9).

(6) Post-SB24344: Secure cable assembly (7) to bracket (26) with loop clamp (23), bolt (25) and nut (24). Tighten the nut with fingers.

(7) Remove nut (4) from cable housing and turn nut (6) all the way on.

(8) Install cable assembly (7) through bracket (5) and loosely secure with nut (4).

(9) Install cable end on exhaust case bell crank (2) with pin (1) and secure with cotterpin (3). Remove lockwire from bellcrank.

C. Adjustment (Rigging) (Ref. Figs. 203 and 204)

NOTE: Expansion of the engine due to normal operating temperature will cause the fuel shut-off cable to pull the tripper sleeve out from the fuel shut-off valve housing. This is an acceptable condition provided the tripper sleeve can be pushed back with a soft faced hammer to a minimum of 0.008 inch below the end of the housing.

(1) Remove fuel waste ejector (Ref. 73-10-03).

CAUTION: DO NOT HAMMER FUEL SHUT-OFF VALVE TRIPPER SLEEVE.

(2) Using a soft drift apply even pressure on tripper sleeve (15, Fig. 204) to make sure sleeve is fully seated.

(3) Measure and record dimension AA (Ref. Fig. 204) from the lug on tripper sleeve assembly (15) to the rear face of housing (7), using depth micrometer.

NOTE: Dimension AA = distance from end of tripper sleeve to end of housing before tightening cable.

(4) If lower end of cable assembly (7, Fig. 203) was not removed from bypass duct (22) or fuel shut-off valve control lever (13) go to step (5).

(5) Set Dimension S (Ref. Fig. 203) as follows:

(a) Adjust nuts (15) and (14) to obtain Dimension S (Ref. View A), where:

Dimension S = 0.540 to 0.580 inch (13.7-14.7 mm).

NOTE: Dimension S = Length of cable end extending beyond fuel shut-off valve lever.

(b) Turn nut (15) against nut (14). Hold nut (15) and tighten and torque nut (14) 24 to 36 lb.in. (2.7-4.1 Nm).

(c) Measure Dimension S to make sure it is within limits.

CAUTION: DO NOT HAMMER FUEL SHUT-OFF VALVE TRIPPER SLEEVE.

(6) Using a soft drift apply even pressure on tripper sleeve (15, Fig. 204) to make sure sleeve is fully seated.

(7) Set tension on tripper sleeve as follows:

(a) Adjust nuts (4 and 6, Fig. 203) to obtain Dimension T (Ref. Section A-A Fig. 204), where:

Dimension T = (Dimension AA - 0.005) ± 0.003 inch

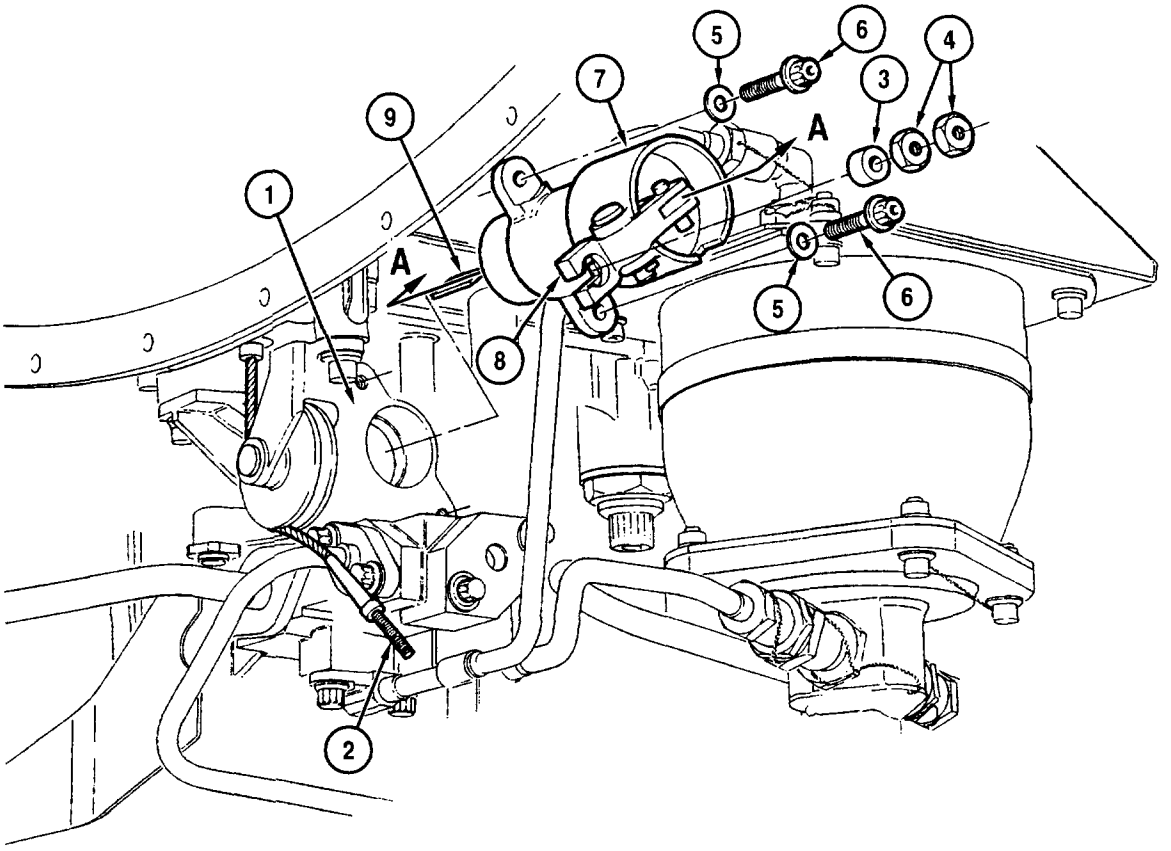
NOTE: The tripper sleeve is set when the cable tension pulls the sleeve out 0.005 ± 0.003 inch from it's seated position in the housing.

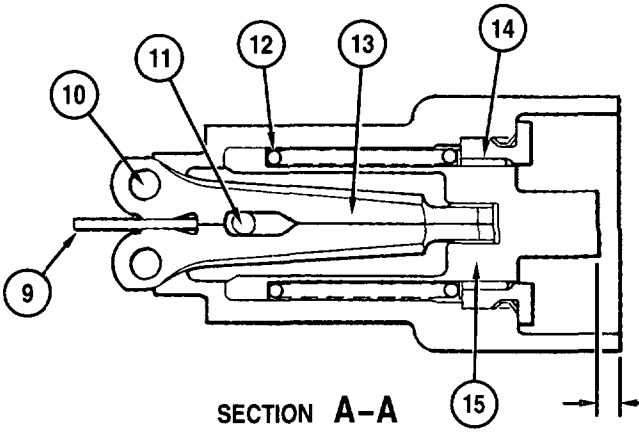
(b) Tighten nut (4), snug against bracket (5). Torque nut (4) 62 to 85 lb.in. (7.0-9.6 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(c) Position cable in hole to dimensions shown in Section A-A, by adjusting clamp (10). Torque nut (11) 27 to 30 lb.in. (3.1-3.4 Nm).

(d) Post-SB24344: Position the cable in the loop clamp (23). Torque nut (24) 27 to 30 lb. in. (3.1-3.4 Nm).





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Emergency Fuel shut-off Valve - Resetting Procedure
Figure 204

Key to Figure 204

1. Fuel Inlet and Shut-off Valve Housing
2. Fuel Shut-off Cable
3. Spacer
4. Nuts
5. Washer
6. Bolt
7. Overspeed Control Linkage Housing
8. Control Lever
9. Release Plate
10. Pin
11. Pin
12. Spring
13. Pivoted Overspeed Control Levers
14. Cover
15. Tripper Sleeve Assembly

CAUTION: DO NOT HAMMER FUEL SHUT-OFF VALVE TRIPPER SLEEVE.

(e) Using a soft drift apply even pressure on tripper sleeve (15, Fig. 204) to make sure sleeve is fully seated.

(f) Check Dimension T and adjust if necessary (Ref. Step (7)).

(8) Lockwire (PWC05-089) nuts (4 and 6, Fig. 203).

(9) Lockwire (PWC05-089) nuts (14 and 15) and install suitable seal to nuts.

(10) Install fuel waste ejector (Ref. 73-10-03).

8. Fuel Drain Valve Adapter

A. Disassembly (Ref. Fig. 205)

NOTE: Refer to Chapter 72-70-01 for removal of fuel drain valve adapter from outer bypass duct.

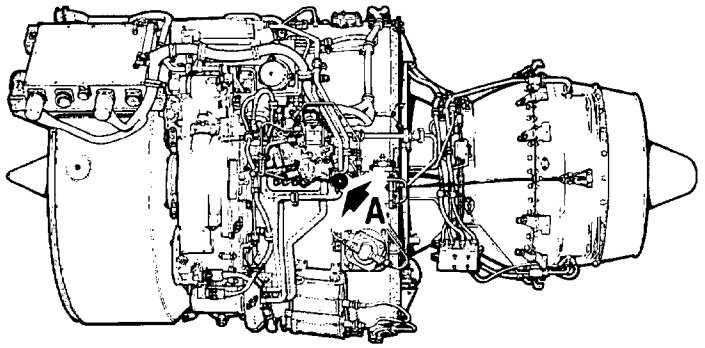
(1) Remove retaining ring (2), drain valve (3) and spring (4) from adapter (1).

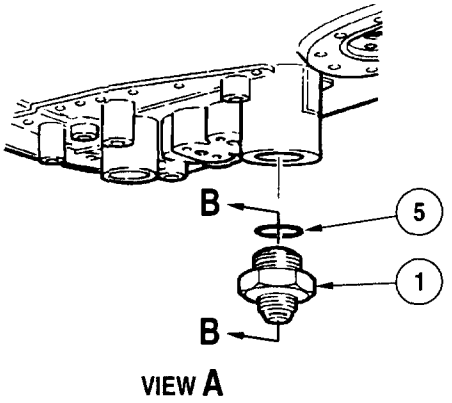
(2) Remove and discard preformed packing (5).

B. Assembly (Ref. Fig. 205)

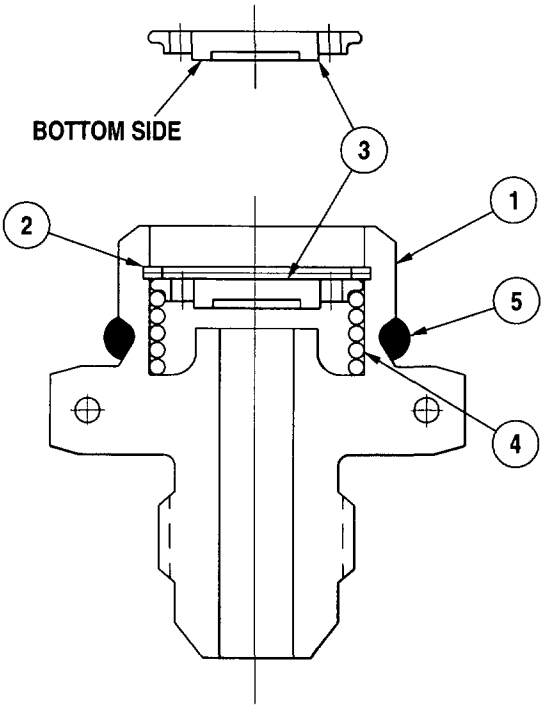
(1) Place spring (4) inside adapter (1) and position the drain valve (3) with bottom side facing the adapter. Push the valve against the spring and install retaining ring (2).

(2) Lubricate and install preformed packing (5). Refer to 72-70-01 for installation of drain valve to the lower bypass duct.

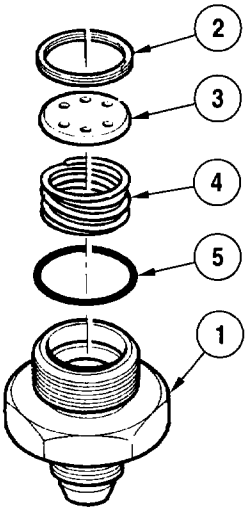




VIEW A



SECTION B-B
SHOWN ASSEMBLED

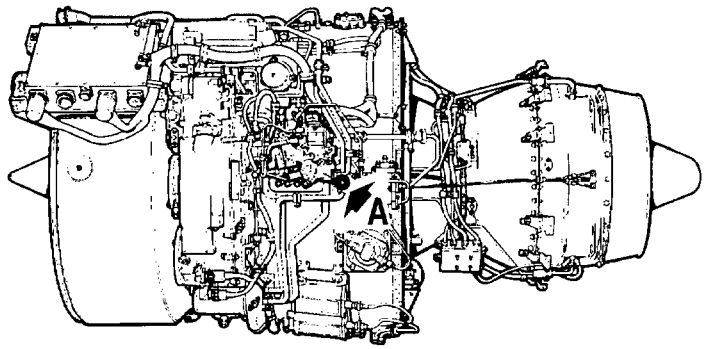


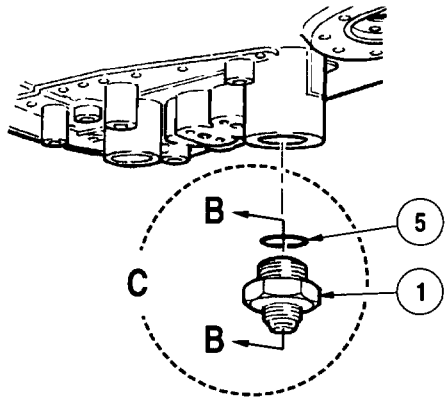
Pre-SB24525 C27885A

Fuel Drain Valve Adapter - Assembly/Disassembly
Figure 205 (Sheet 1 of 2)

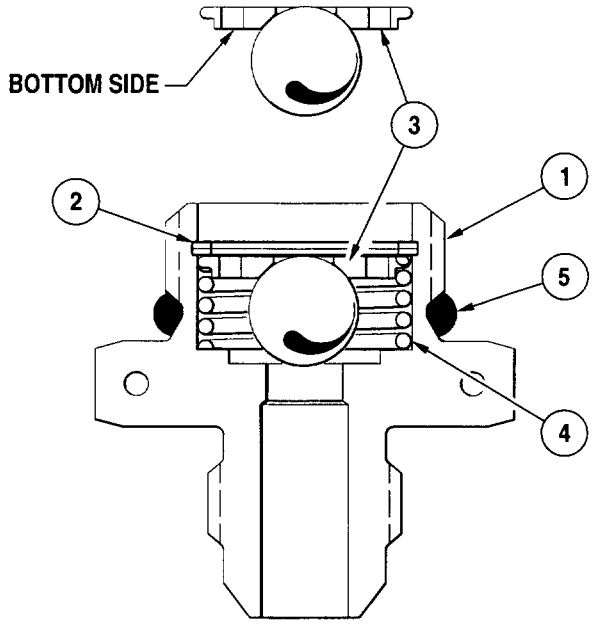
Key to Figure 205

1. Drain Valve Adapter
2. Retaining Ring
3. Drain Valve
4. Spring
5. Preformed Packing





VIEW A



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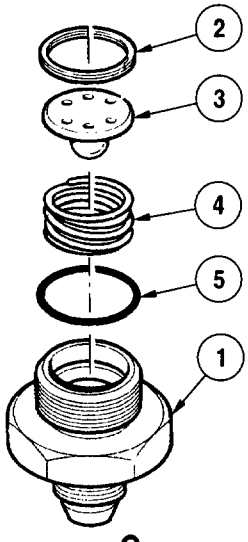

DETAIL C

Post-SB24525

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Fuel Drain Valve Adapter - Assembly/Disassembly
Figure 205 (Sheet 2)

TABLE OF CONTENTS

SUBJECT	PAGE
HYDROMECH. METERING UNIT - MAINTENANCE PRACTICES	**73-20-01**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Hydromechanical Metering Unit (HMU)	201
A. Removal	201
B. Installation	204
C. PMA - Removal/Installation	205
6. Motive Flow Valve (PW305A Only)	205
A. Removal (Pre-SB24589 only)	205
B. Installation (Pre-SB24589 only)	205
ELECTRONIC ENGINE CONTROL (EEC) - MAINTENANCE PRACTICES	**73-20-02**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. EEC	201
A. Place in "Swingdown" Position (if applicable)	201
B. Restore to Normal Position from "Swingdown" Position	203
C. Removal of EEC	204
D. Installation of EEC	209
6. EEC Mounting Brackets and N1 Speed Trim Box	211
A. Removal of EEC Mounting Brackets	211
B. Removal of N1 Speed Trim Box	216

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
ELECTRONIC ENGINE CONTROL (EEC) - MAINTENANCE PRACTICES (Cont'd)	**73-20-02**
C. Installation of EEC Mounting Brackets	217
D. Installation of N1 Speed Trim Box	217
7. Ground Strap	218
A. Removal	218
B. Installation	224
8. Trim Plug	225
A. Removal	225
B. Installation	226
WIRING HARNESSES - MAINTENANCE PRACTICES	**73-20-03**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Outer Wiring Harness	201
A. Removal	201
B. Installation	210
6. Core Wiring Harness	212
A. Removal of Rear Core Wiring Harness	212
B. Installation of Rear Core Wiring Harness	216
C. Removal of Front Core Wiring Harness	217
D. Installation of Front Core Wiring Harness	221

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Nov 28/2008
	2 blank	Nov 28/2008
Contents	1	Nov 28/2008
	2	Nov 28/2008
73-20-01 Maintenance Practices	201	Nov 09/2007
	202	Nov 09/2007
	203	Nov 09/2007
	204	Nov 09/2007
	204 A deleted	
	204 B deleted	
	205	Nov 09/2007
	206	Nov 09/2007
	207	Nov 09/2007
	208 blank	Nov 09/2007
73-20-02 Maintenance Practices	201	Mar 16/2007
	202	Mar 16/2007
	203	Mar 16/2007
	204	Mar 16/2007
	205	Mar 16/2007
	206	Mar 16/2007
	207	Mar 16/2007
	208	Mar 16/2007
	209	Mar 16/2007
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	226	Mar 16/2007
	227	Mar 16/2007
	228	Mar 16/2007
	229	Mar 16/2007
	230 blank	Mar 16/2007
73-20-03 Maintenance Practices	201	Nov 28/2008
	202	Nov 28/2008
	203	Nov 28/2008
	204	Nov 28/2008
	205	Nov 28/2008
	206	Nov 28/2008
	207	Nov 28/2008
	208	Nov 28/2008
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HYDROMECH. METERING UNIT - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after sub-assembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC03-001	Oil, Engine Lubricating

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC60142-100	Wrench

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Hydromechanical Metering Unit (HMU)

   A. Removal (Ref. Fig. 201)

   CAUTION: ENSURE AIRFRAME ELECTRICAL POWER IS OFF WHEN DISCONNECTING ELECTRICAL CONNECTORS.

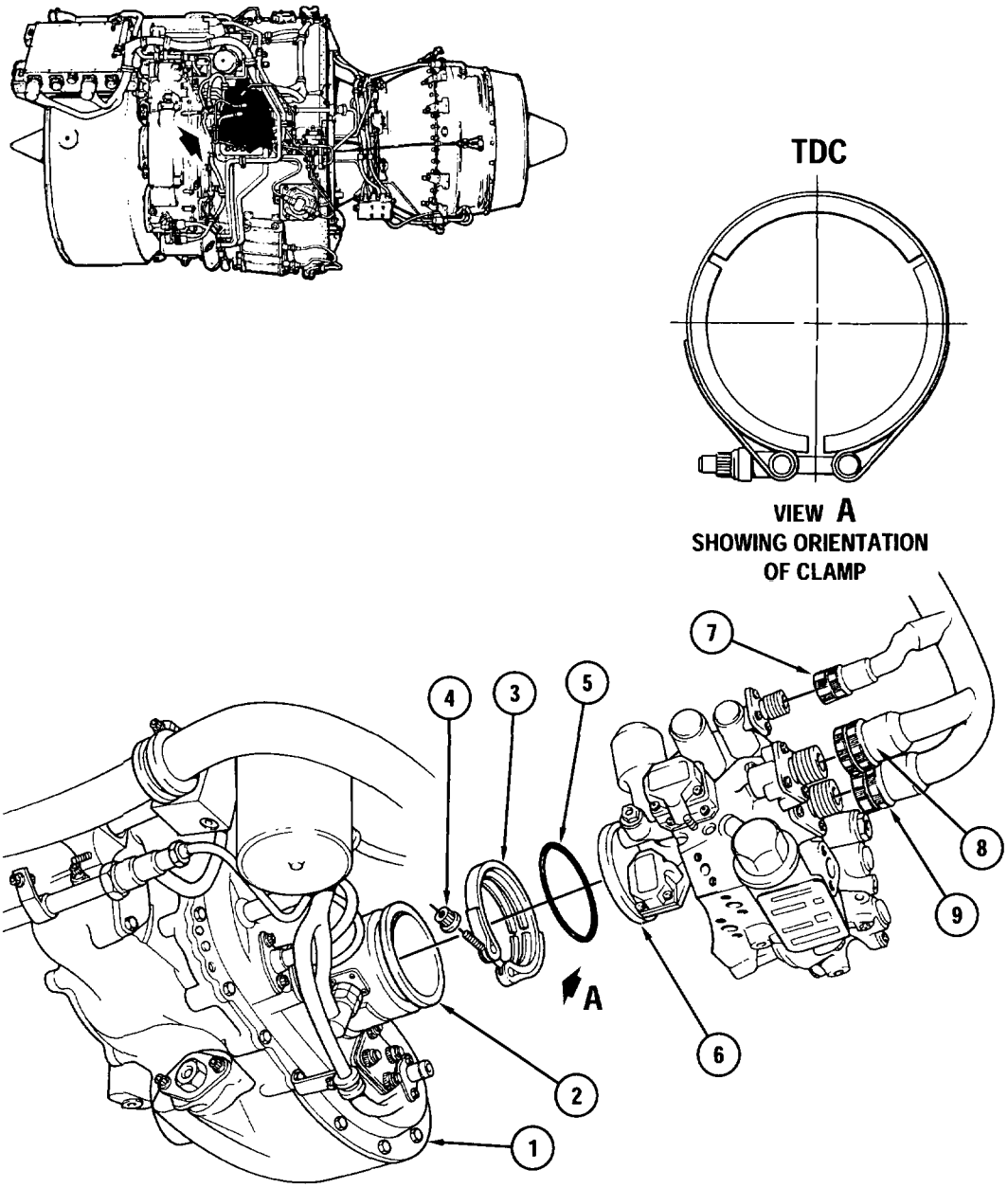
   CAUTION: FOR PW305A ENGINES, THE FUEL PUMP AND MOTIVE FLOW VALVE MUST BE REMOVED FROM PRE-SB24589 HMUs (REF. 73-10-02) AND PARA. 6. AND RE-INSTALLED IN THE REPLACEMENT HMU. POST-SB24589 HMUs HAVE AN INTEGRAL FUEL PUMP AND MOTIVE FLOW VALVE. DO NOT REMOVE THE FUEL PUMP AND/OR MOTIVE FLOW VALVE FROM POST-SB24589 HMUs.

   CAUTION: FOR PW305B ENGINES, THE FUEL PUMP AND MOTIVE FLOW VALVE MUST BE REMOVED AND RE-INSTALLED IN THE REPLACEMENT HMU.

   (1) Select maintenance test discrete ON before HMU removal (Ref. Aircraft Maintenance Manual).

   (2) Provide drain tray under engine to collect fuel.

   (3) Remove airframe fuel inlet connection from HMU (Ref. Aircraft Maintenance Manual).



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Hydromechanical Metering Unit - Removal/Installation
Figure 201

Key to Figure 201

1. Accessory Gearbox (Ref.)
2. AC Generator (Ref.)
3. Flange Clamp
4. Nut
5. Preformed Packing
6. Hydromechanical Metering Unit
7. Wiring Harness Connector P17 - Standby Shutdown
8. Wiring Harness Connector P15 - Channel "A"
9. Wiring Harness Connector P16 - Channel "B"

(4) Remove wiring harness connectors P15, P16 and P17 (8, 9 and 7).

(5) Remove all fuel pressure and bypass tubes (Ref. 73-10-01).

(6) For PW305B Engines:

(a) Remove fuel pump from the HMU (Ref. 73-10-02).

(7) For PW305A Engines:

(a) Pre-SB24589: Remove fuel pump and motive flow valve from the HMU (Ref. 73-10-02) and Para. 6. If the HMU is to be replaced, install a blanking cover on the valve mounting port on the HMU and pack in the appropriate shipping case.

(b) Post-SB24589: Do not remove the fuel pump and/or the motive flow valve from the HMU.

(8) Plug/cap all exposed openings and electrical connections.

(9) Remove lockwire, if installed, and loosen flange clamp (3) by removing nut (4).

CAUTION: DIRT MUST NOT ENTER THE FUEL SYSTEM. TAKE ALL NECESSARY PRECAUTIONS TO AVOID INGRESS OF FOREIGN MATERIAL. WHEREVER POSSIBLE, INSTALL PROTECTIVE CAPS OR PLUGS ON ALL EXPOSED OPENINGS BEFORE REMOVING THE HMU.

CAUTION: USE CARE WHEN REMOVING HMU FROM ENGINE. USE ADEQUATE SUPPORT TO ENSURE HMU IS REMOVED SMOOTHLY AND IN A STRAIGHT LINE AWAY FROM THE MATING FACE ON AGB. DO NOT DAMAGE AGB MATING SURFACE ON HMU OR AGB.

(10) Remove HMU from mounting face of AC generator (2) and discard preformed packing (5).

B. Installation (Ref. Fig. 201)

CAUTION: ENSURE AIRFRAME ELECTRICAL POWER IS OFF WHEN CONNECTING ELECTRICAL CONNECTORS.

CAUTION: ENSURE CONNECTOR PLUGS ARE FREE FROM MOISTURE; IF NECESSARY, DRY USING HEAT GUN.

CAUTION: USE ONLY APPROVED TOOLS TO TIGHTEN HARNESS CONNECTORS. CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY THE BLUE COLOR AND IS VISIBLE; RED COLOR BAND MUST NOT BE VISIBLE.

(1) For PW305B Engines:

(a) Install fuel pump in the HMU (Ref. 73-10-02).

(2) For PW305A Engines:

(a) Pre-SB24589: Install fuel pump and motive flow valve in the HMU (Ref. 73-10-02) and Para. 6.

(b) Post-SB24589: The fuel pump and motive flow valve are integral with the HMU. Installation is not required.

(3) Lubricate new preformed packing (5) with engine oil (PWC03-001) and install on HMU.

(4) Align splined shaft of fuel pump (if installed) with shaft in accessory gearbox, and dowel pin on HMU with hole in mating face of AC generator and install HMU.

(5) Install flange clamp (3) with nut (4). Ensure clamp is oriented correctly (Ref. View A-A). Torque clamp nut (4) 32 to 36 lb.in. (3.5-4.1 Nm) and gently tap around circumference of clamp to ensure proper seating. Final torque nut (4) 50 to 60 lb.in. (5.7-6.8 Nm).

(6) Apply electrical contact enhancer to connectors (Ref. 70-00-00, CLEANING).

(7) Install wiring harness connectors P15, P16 and P17 (8, 9 and 7). Torque connector (7) 21 to 26 lb.in. (2.4-2.9 Nm) and connectors (8), (9) 36 to 41 lb.in. (4.1-4.6 Nm) using wrench (PWC60142-100).

(8) Post-SB24507 or Post-SB24372: Apply electrical insulation tape to connector (Ref. 70-00-00, REMOVAL/INSTALLATION).

(9) Install fuel pressure and bypass tubes (Ref. 73-10-01), except do not connect primary and secondary fuel supply tubes to fuel dump valve.

(10) Perform depreservation procedure (Ref. 72-00-00, SERVICING) to purge HMU of preserving fluid.

(11) Restore electrical power to appropriate system and reset EEC circuit breaker to ON.

(12) Select maintenance test discrete OFF.

(13) Refer to Chapter 71-00-00, for checks following installation of HMU.

C. PMA - Removal/Installation

(1) Refer to 72-60-01 for Removal/Installation of AC Generator (PMA).

6. Motive Flow Valve (PW305A Only)

A. Removal (Pre-SB24589 only) (Ref. Fig. 202)

CAUTION: IF A PRE-SB24589 HMU IS TO BE REPLACED, THE FUEL PUMP AND MOTIVE FLOW VALVE MUST BE REMOVED AND RE-INSTALLED IN THE REPLACEMENT PRE-SB24589 HMU.

CAUTION: DO NOT REMOVE THE FUEL PUMP AND/OR MOTIVE FLOW VALVE FROM A POST-SB24589 HMU.

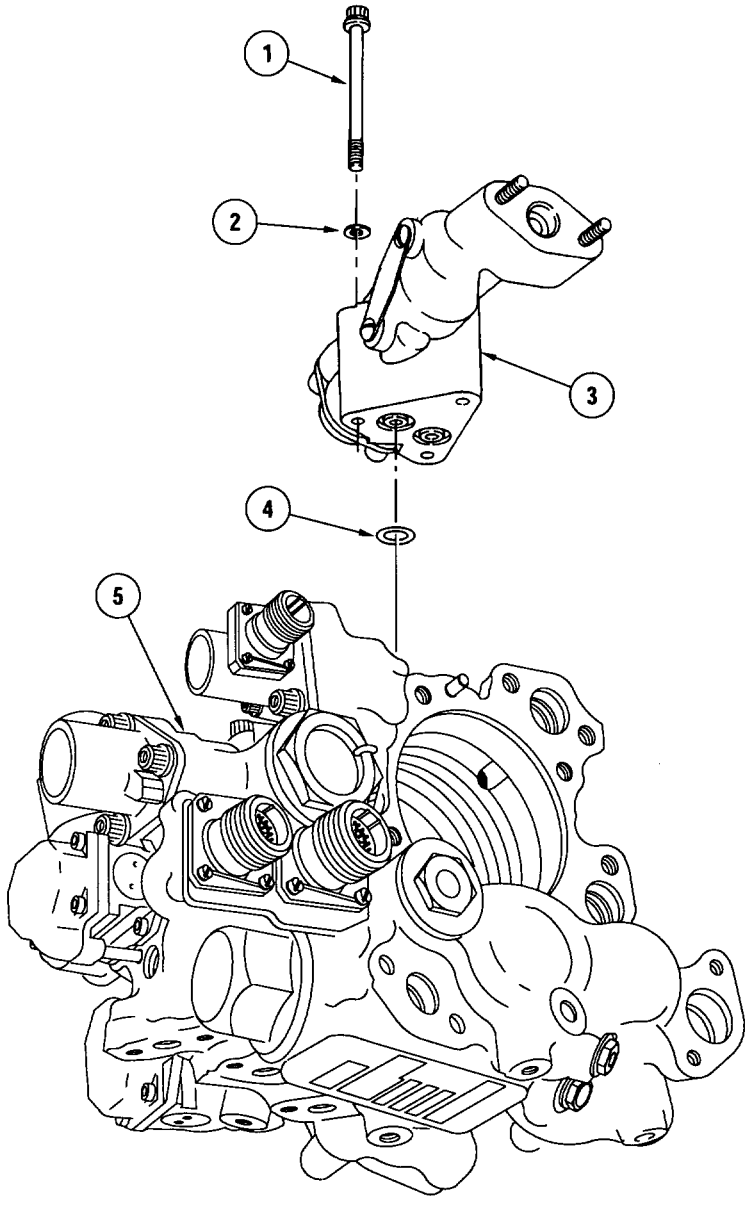
(1) Remove three bolts (1), three washers (2) and remove motive flow valve (3) from the HMU (5). Remove and discard two preformed packings (4) from the valve (3).

B. Installation (Pre-SB24589 only) (Ref. Fig. 202)

CAUTION: IF A PRE-SB24589 HMU IS TO BE REPLACED, THE FUEL PUMP AND MOTIVE FLOW VALVE MUST BE INSTALLED IN THE REPLACEMENT PRE-SB24589 HMU.

(1) If the motive flow valve is being installed to a replacement HMU, remove the blanking (shipping) cover of the valve mounting port from the HMU.

(2) Install two new preformed packings (4) to the motive flow valve (3) and install valve on mounting port on the HMU (5). Secure valve with three washers (2) and three bolts (1). Torque 32 to 36 lb.in. (3.5-4.1 Nm).



C61689

Removal/Installation of Motive Flow Valve (Pre-SB24589) (PW305A only)
Figure 202

Key to Figure 202

1. Bolt
2. Washer
3. Motive Flow Valve
4. Preformed Packing
5. HMU

ELECTRONIC ENGINE CONTROL (EEC) - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes,/component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC05-089	Lockwire
PWC09-001	Sealant, Silicone Rubber
PWC09-008	Sealant, Silicone Rubber
PWC09-008A	Sealant, Silicone Rubber
PWC11-027	Solvent, Petroleum

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC60142-200	Wrench

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. EEC

   A. Place in "Swingdown" Position (if applicable) (Ref. Fig. 201)

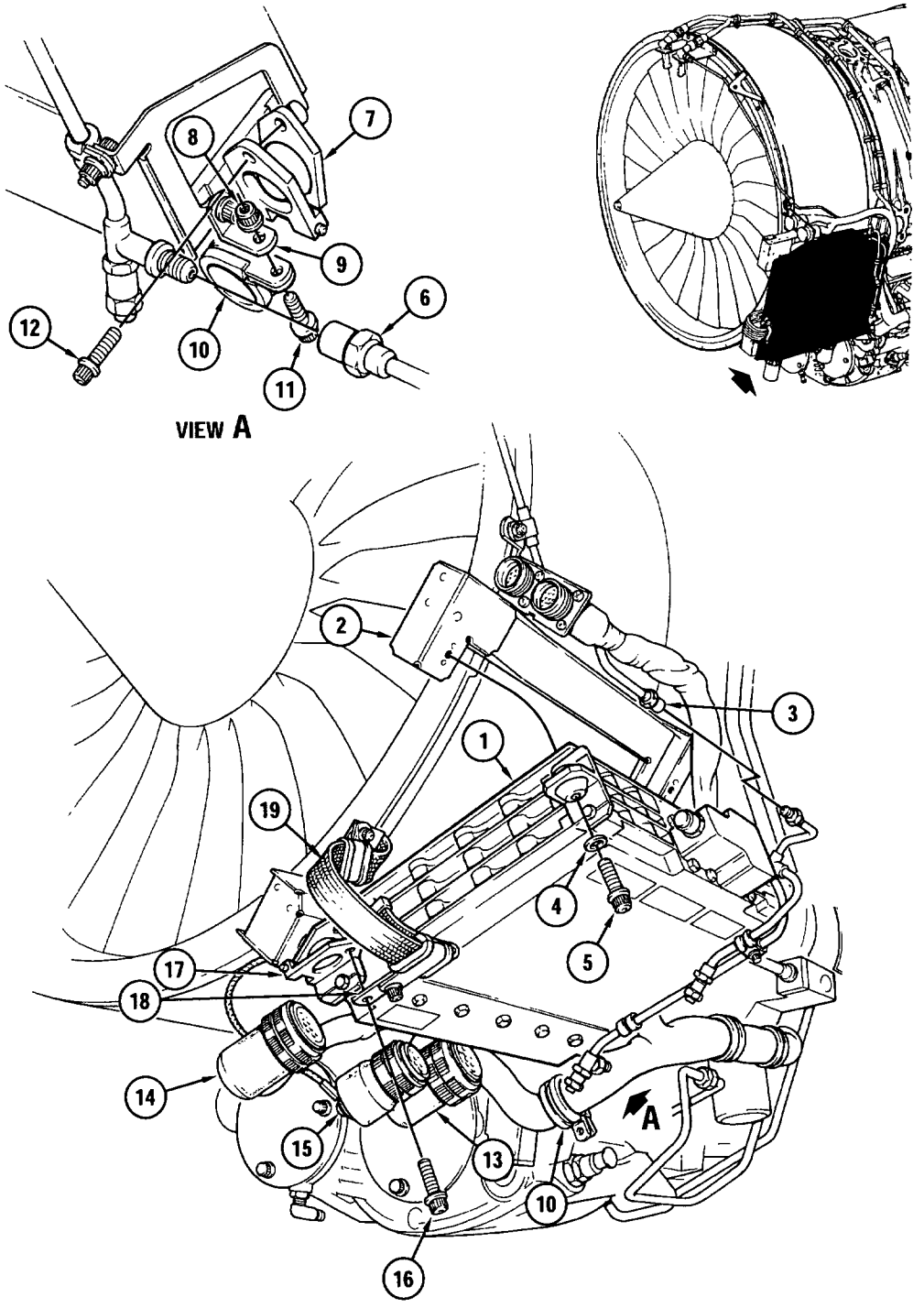
      NOTE: This procedure may be required to gain access to the engine inlet nacelle (airframe supplied) attachment points on the front flange of the fan case.

      (1) Remove lockwire and loosen coupling nuts (3 and 6).

      (2) Plug/cap all openings and exposed threads.

      CAUTION: ENSURE AIRFRAME 28 VDC POWER IS OFF WHEN DISCONNECTING ELECTRICAL CONNECTORS.

      (3) Disconnect electrical connectors P1 and P4 (14 and 13) and trim plug (15).



ORIGINAL
As Received By
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C19812

Electronic Engine Control - "Swingdown" Feature
Figure 201

Key to Figure 201

1. Electronic Engine Control
2. Upper Mounting Bracket
3. Coupling Nut
4. Washer
5. Bolt
6. Coupling Nut
7. Hinged Mounting Bracket
8. Self-locking Nut
9. Bracket
10. Loop Clamp
11. Bolt
12. Bolt
13. Wiring Harness Connector "P4"
14. Wiring Harness Connector "P1"
15. Trim Plug Connector "P3"
16. Bolt
17. Hinged Mounting Bracket
18. Bracket
19. Ground Strap

(4) Remove bolt (16) securing ground strap (19) and bracket (18) to hinged mounting bracket (17).

(5) Remove bolt (11) from hinged mounting bracket (7).

(6) Remove nut (8), bolt (11) and loop clamp (10) from bracket (9) and wiring harness.

CAUTION: MAXIMUM SWINGDOWN ANGLE FOR EEC IS 40 DEGREES FROM ORIGINAL POSITION.

(7) Remove two bolts (5) and washers (4) and swing EEC down to desired position.

B. Restore to Normal Position from "Swingdown" Position (Ref. Fig. 201)

CAUTION: WHILE RETURNING EEC TO NORMAL POSITION, ENSURE EEC UPPER MOUNTS DO NOT DAMAGE EXTERNAL WIRING HARNESS.

(1) Carefully swing EEC to normal position.

(2) Secure EEC to upper mounting bracket (2) with two bolts (5) and washers (4). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(3) Remove protective plugs/caps.

(4) Connect air pressure tube coupling nuts (3 and 6). Torque 90 to 100 lb.in. (10.2-11.3 Nm) and lockwire (PWC05-089).

(5) Secure ground strap (19) and bracket (18) to hinged mounting bracket (17) with bolt (16). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(6) Install bolt (12) into hinged mounting bracket (7). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(7) Place loop clamp (10) over wiring harness and secure to bracket (9) with bolt (11) and nut (8). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

CAUTION: ENSURE AIRFRAME 28 VDC POWER IS OFF WHEN CONNECTING ELECTRICAL CONNECTORS.

CAUTION: ENSURE CONNECTOR PLUGS ARE FREE FROM MOISTURE; IF NECESSARY, DRY USING HEAT GUN.

CAUTION: USE ONLY APPROVED TOOLS TO TIGHTEN HARNESS CONNECTORS. CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY THE BLUE COLOR BAND IS VISIBLE; RED COLOR BAND MUST NOT BE VISIBLE.

(8) Remove protective caps/plugs and connect P1 and P4 connectors (14 and 13) to EEC. Connect trim plug connector P3 (15). Torque connectors P1, P3 and P4 99 to 104 lb.in. (11.2-11.7 Nm) using wrench (PWC60142-200). Connect airframe electrical connectors P2 and P5.

C. Removal of EEC (Ref. Fig. 202)

CAUTION: ENSURE AIRFRAME 28 VDC POWER IS OFF WHEN DISCONNECTING ELECTRICAL CONNECTORS.

(1) Select maintenance test discrete ON before EEC removal (Ref. Aircraft Maintenance Manual).

(2) Pre-SB24434:

(a) Disconnect engine electrical connectors P1, P3 and P4 (29, 30 and 31) from EEC (1). Disconnect airframe electrical connectors P2, P5 and install protective plugs/caps.

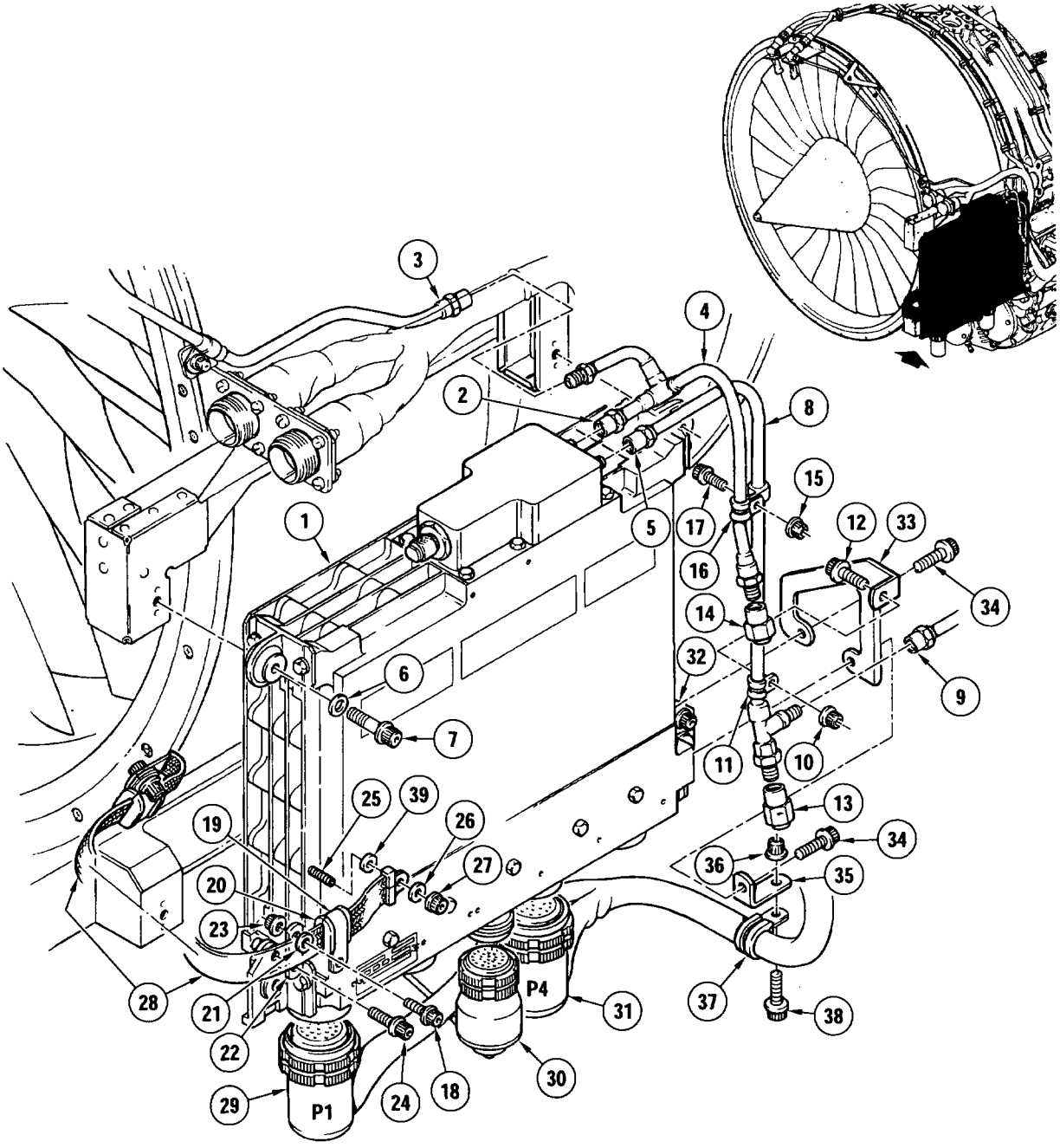
CAUTION: DO NOT REMOVE TRIM PLUG P3 FROM THE ENGINE. THE TRIM PLUG IS MATCHED TO THE ENGINE SERIAL NO. AND IS NOT INTERCHANGEABLE WITH ANY OTHER TRIM PLUG.

(b) Remove lockwire and loosen coupling nuts (2, 3, 5, 9) and cap assemblies (13 and 14). Remove tubes (4 and 8) as an assembly.

CAUTION: INSTALL PROTECTIVE CAPS OVER THE OUTSIDE OF ELECTRICAL CONNECTORS. DO NOT INSTALL PROTECTIVE CAPS ON THE INSIDE OF ELECTRICAL CONNECTOR SLEEVES. IMPROPER INSTALLATION OF CAP CAN DAMAGE THE INSIDE OF THE CONNECTOR (Ref. 70-00-00, REMOVAL/INSTALLATION).

(c) Plug/cap all openings.

(d) Remove nuts (10 and 15), bolts (12 and 17) and loop clamps (11 and 16).



PRE-SB24434

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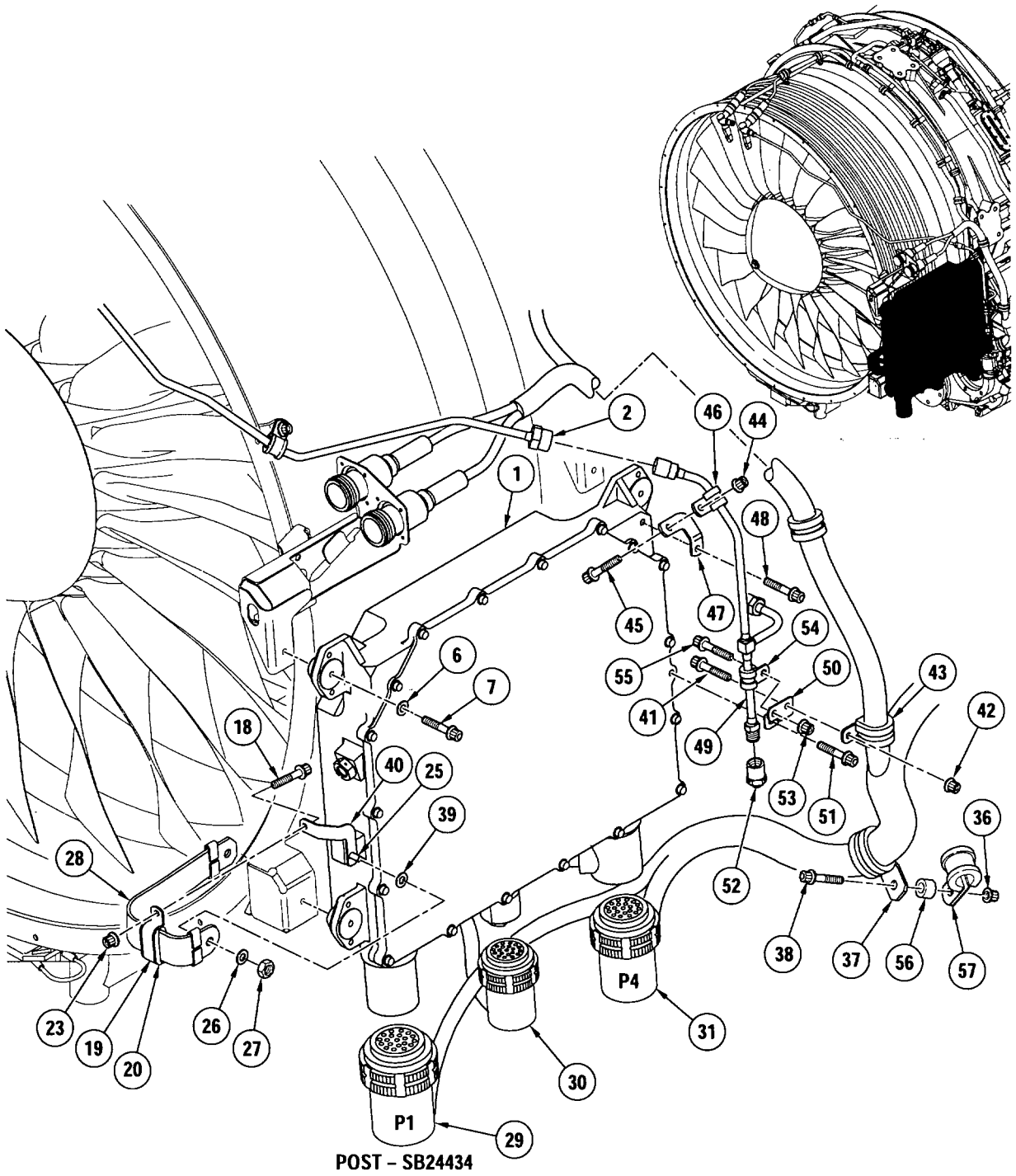
C19732B

Electronic Engine Control - Removal/Installation
Figure 202 (Sheet 1 of 2)

Key to Figure 202

1. Electronic Engine Control (EEC)
2. Coupling Nut
3. Coupling Nut
4. P1 Air Pressure Tube Assembly (Pre-SB24030)
5. Coupling Nut
6. Washer
7. Bolt
8. P3 Air Pressure Tube Assembly
9. Coupling Nut
10. Self-locking Nut
11. Loop Clamp
12. Bolt
13. Cap Assembly
14. Cap Assembly
15. Self-locking Nut
16. Loop Clamp
17. Bolt
18. Bolt
19. Loop Clamp
20. Loop Clamp Cushion
21. Washer
22. Flat Bracket (Pre-SB24030)
23. Self-locking Nut
24. Bolt
25. Ground Terminal (integral with EEC)
26. Washer
27. Self-locking Nut
28. Ground Strap
29. Wiring Harness Connector "P1"
30. Trim Plug
31. Wiring Harness Connector "P4"
32. Mounting Bracket (part of EEC)
33. Tube Support Bracket
34. Bolt
35. Angle Bracket
36. Self-locking Nut
37. Loop Clamp
38. Bolt
39. Washer
40. Bracket (Post-SB24434)
41. Double Hex Bolt (Post-SB24434)
42. Nut (Post-SB24434)
43. Loop Clamp (Post-SB24434)
44. Nut (Post-SB24434)
45. Double Hex Bolt (Post-SB24434)
46. Loop Clamp (Post-SB24434)
47. Bracket (Post-SB24434)
48. Double Hex Bolt (Post-SB24434)
49. Tube (Post-SB24434)
50. Bracket (Post-SB24434)
51. Double Hex Bolt (Post-SB24434)
52. Cap Assembly (Post-SB24434)
53. Nut (Post-SB24434)
54. Loop Clamp (Post-SB24434)
55. Double Hex Bolt (Post-SB24434)
56. Spacer (Post-SB24434)
57. Loop Clamp (Post-SB24434)



ORIGINAL
As Received By
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C106352

Electronic Engine Control - Removal/Installation
Figure 202 (Sheet 2)

(e) Remove bolt (24) and disconnect strap from EEC hinged mounting point.

(f) Remove strap end from EEC ground terminal.

CAUTION: MAKE SURE EEC IS PROPERLY SUPPORTED BEFORE REMOVING BOLTS (7). REMOVE LOWER TWO BOLTS AND WASHERS FIRST. DAMAGE CAN OCCUR TO MOUNTING FEET IF EEC MOVES FORWARD UNDER ITS OWN WEIGHT WHEN REMOVING BOLTS.

(g) Support EEC and remove two lower bolts (7) and washers (6). Remove two upper bolts (7) and washers (6). Remove EEC from engine.

(h) Remove bolts (34) and brackets (33 and 35).

(i) Reinstall bolts (34), fingertight, to secure mounting bracket (32) to EEC.

NOTE: Mounting bracket (32) is part of EEC.

(3) Post-SB24434:

(a) Disconnect engine electrical connectors P1, P3 and P4 (29, 30 and 31) from EEC (1). Disconnect airframe electrical connectors P2, P5 and install protective plugs/caps.

CAUTION: DO NOT REMOVE TRIM PLUG P3 FROM THE ENGINE. THE TRIM PLUG IS MATCHED TO THE ENGINE SERIAL NO. AND IS NOT INTERCHANGEABLE WITH ANY OTHER TRIM PLUG.

(b) Loosen coupling nut (2) and cap assembly (52).

(c) Remove nuts (44), (42), (53), bolts (45), (41), (55), and loop clamps (46), (54), (43).

(d) Remove tube (49).

(e) Remove bolts (48), (51), and brackets (47), (50).

CAUTION: INSTALL PROTECTIVE CAPS OVER THE OUTSIDE OF ELECTRICAL CONNECTORS. DO NOT INSTALL PROTECTIVE CAPS ON THE INSIDE OF ELECTRICAL CONNECTOR SLEEVES. IMPROPER INSTALLATION OF CAP CAN DAMAGE THE INSIDE OF THE CONNECTOR (Ref. 70-00-00, REMOVAL/INSTALLATION).

(f) Plug/cap all openings.

(g) Remove self-locking nut (27) and washer (26) and disconnect ground strap (28) from EEC ground terminal (25).

(h) Remove nut (23), bolt (18), loop clamp (19) and loop clamp cushion (20) from ground strap (28) and bracket (40).

(i) Remove bracket (40) from EEC ground terminal (25).

CAUTION: MAKE SURE EEC IS PROPERLY SUPPORTED BEFORE REMOVING BOLTS (7). REMOVE LOWER TWO BOLTS AND WASHERS FIRST. DAMAGE CAN OCCUR TO MOUNTING FEET IF EEC MOVES FORWARD UNDER ITS OWN WEIGHT WHEN REMOVING BOLTS.

(j) Support EEC and remove two lower bolts (7) and washers (6). Remove two upper bolts (7) and washers (6). Remove EEC from engine.

D. Installation of EEC (Ref. Fig. 202)

CAUTION: POST-SB24337: MAKE SURE THE EEC ON BOTH ENGINES IS THE SAME SB STANDARD. DO NOT MIX PRE- AND POST-SB24337 EECs.

CAUTION: ENSURE AIRFRAME 28 VDC POWER IS OFF WHEN CONNECTING ELECTRICAL CONNECTORS.

CAUTION: ENSURE CONNECTOR PLUGS ARE FREE FROM MOISTURE; IF NECESSARY, DRY USING HEAT GUN.

CAUTION: USE ONLY APPROVED TOOLS TO TIGHTEN HARNESS CONNECTORS. CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY THE BLUE COLOR BAND IS VISIBLE; RED COLOR BAND MUST NOT BE VISIBLE.

(1) Pre-SB24434:

(a) Remove bolts (34) from EEC mounting bracket (32) and remove washers, if installed.

(b) Install brackets (35 and 33) on mounting bracket (32) and secure with bolts (34). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm).

CAUTION: DO NOT LUBRICATE THE THREADS.

(c) Locate EEC (1) on support brackets and secure with four bolts (7) and washers (6). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm).

(d) Clean ground terminal (25) and surrounding area using petroleum solvent (PWC11-027).

(e) Install end of grounding strap to EEC terminal.

(f) Install grounding strap bracket on hinged EEC mounting bracket with bolt (24). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(g) Install rubber cushions (20) in loop clamp (19).

CAUTION: DO NOT LUBRICATE THREADS.

(h) Torque nut (27) on ground terminal (25) 32 to 36 lb.in. (3.6-4.0 Nm). Apply coat of silicone sealant (PWC09-001) to ground terminal.

(i) Assemble cap assemblies (13 and 14) on air pressure tubes (4 and 8). Torque 90 to 100 lb.in. (10.2-11.3 Nm) and lockwire (PWC05-089).

(j) Position P3 air pressure tube (8) on EEC and secure with coupling nut (5), fingertight. Connect with coupling nut (9) on mating air pressure tube on engine, fingertight.

CAUTION: DO NOT LUBRICATE THREADS.

(k) Fasten loop clamp (11) to bracket (33) and P3 air pressure tube (8) with bolt (12) and nut (10). Torque 27 to 30 lb.in. (3.1-3.4 Nm).

(l) Torque coupling nuts (5 and 9) 90 to 100 lb.in. (10.2-11.3 Nm) and lockwire (PWC05-089).

(m) Align P1 air pressure tube (4) with EEC and mating air pressure tube on outside of fan case. Connect coupling nuts (2 and 3) fingertight.

(n) Install loop clamp (16) with bolt (17) and nut (15). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(o) Torque coupling nut (2) 70 to 80 lb.in. (7.9-9.0 Nm) and lockwire (PWC05-089). Torque coupling nut (3) 90 to 100 lb.in. (10.2-11.3 Nm).

(p) Apply electrical contact enhancer to connectors (Ref. 70-00-00, CLEANING).

(q) Remove protective caps/plugs and connect P1 and P4 connectors (29 and 31) to EEC. Connect trim plug P3 (30). Torque connectors P1 and P4 99 to 104 lb.in. (11.2-11.7 Nm) using wrench (PWC60142-200). Connect airframe electrical connectors P2 and P5.

(r) Post-SB24507 or Post-SB24372: Apply electrical insulation tape to connector (Ref. 70-00-00, REMOVAL/INSTALLATION).

(s) Install loop clamp (37) over wiring harness and secure to bracket (35) with bolt (38) and nut (36). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(t) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).

(u) Select airframe 28 VDC power ON.

(v) Make sure there are no EEC fault lamps illuminated. If fault lamps are illuminated, refer to 72-00-00, FAULT ISOLATION.

(w) Select maintenance discrete OFF after EEC installation and before engine operations (Ref. Aircraft Maintenance Manual).

(x) Refer to Chapter 71-00-00, for checks following installation of EEC.

(2) Post-SB24434:

CAUTION: DO NOT LUBRICATE THE THREADS.

(a) Locate EEC (1) on support brackets and secure with four bolts (7) and washers (6). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm).

(b) Clean ground terminal (25) and surrounding area using petroleum solvent (PWC11-027).

CAUTION: DO NOT LUBRICATE THREADS.

(c) Install bracket (40), washers (39) and (26), ground strap (28), and nut (27) on EEC terminal (25). Torque 32 to 36 lb.in. (3.6-4.0 Nm). Apply coat of silicone sealant (PWC09-001) to ground terminal.

(d) Secure ground strap with self-locking nut (23), bolt (18), loop clamp (19) and loop clamp cushion (20). Torque self-locking nut (23) 32 to 36 lb.in. (3.6-4.0 Nm).

(e) Install brackets (47), (50) and bolts (48), (51) on EEC (1). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm).

(f) Assemble cap assembly (52) on tube (49). Torque 90 to 100 lb.in. (10.2-11.3 Nm) and lockwire (PWC05-089).

(g) Position tube (49) and secure with nuts (44), (53), bolts (45), (55), and loop clamps (46), (54). Torque 27 to 30 lb.in. (3.1-3.4 Nm).

(h) Connect coupling nut (2) to tube (49). Torque 50 to 60 lb.in. (5.7-6.8 Nm).

(i) Remove protective caps/plugs and connect P1 and P4 connectors (29) and (31) to EEC. Connect trim plug P3 (30). Torque connectors P1 and P4 99 to 104 lb.in. (11.2-11.7 Nm) using wrench (PWC60142-200). Connect airframe electrical connectors P2 and P5.

(j) Post-SB24507 or Post-SB24372: Apply electrical insulation tape to connector (Ref. 70-00-00, REMOVAL/INSTALLATION).

(k) Install loop clamp (43) over wiring harness and secure to bracket (50) with bolt (41) and nut (42). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(3) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).

(4) Select airframe 28 VDC power ON.

(5) Make sure there are no EEC fault lamps illuminated. If fault lamps are illuminated, refer to 72-00-00, FAULT ISOLATION.

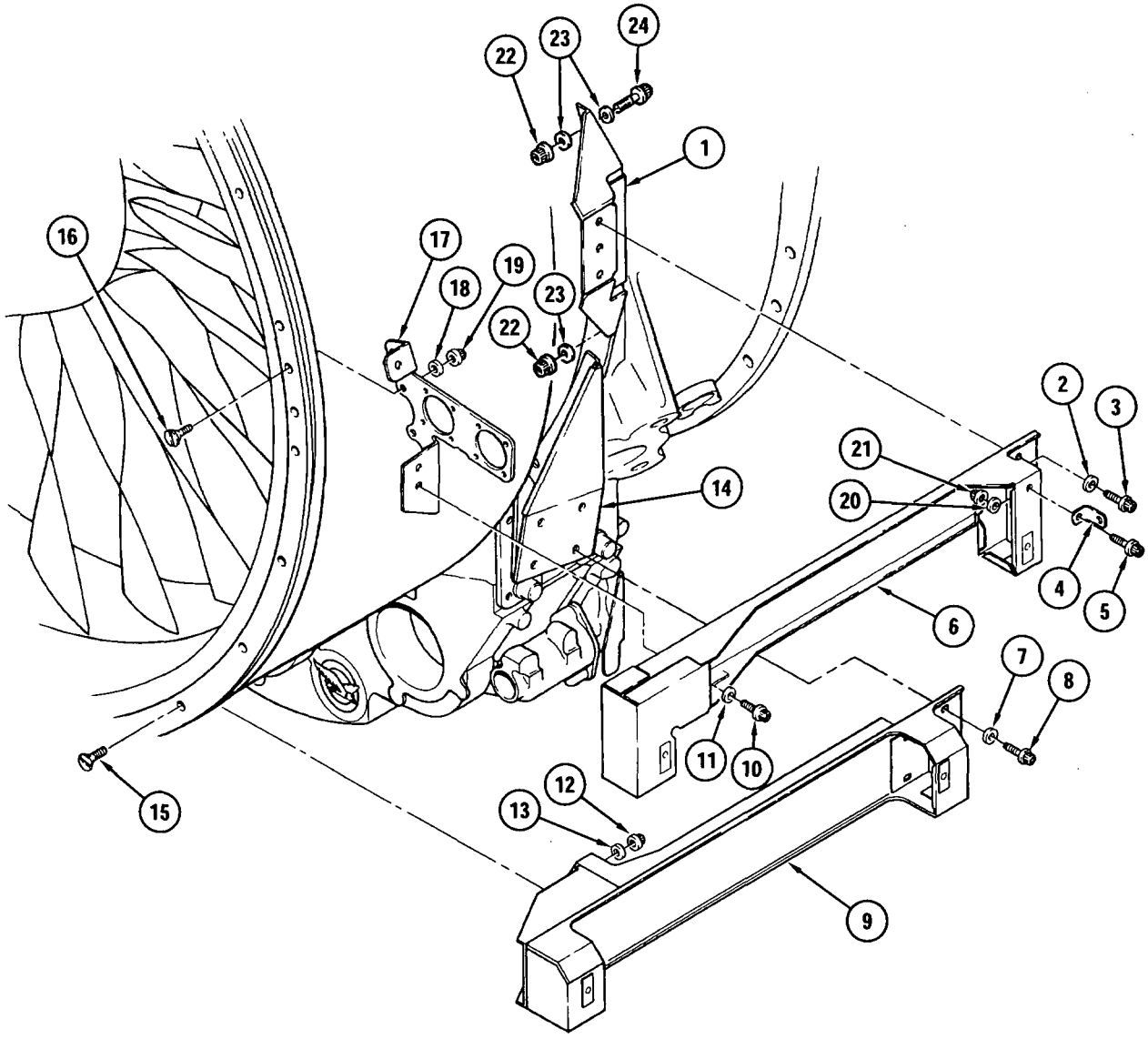
(6) Select maintenance discrete OFF after EEC installation and before engine operations (Ref. Aircraft Maintenance Manual).

(7) Refer to Chapter 71-00-00, for checks following installation of EEC.

6. EEC Mounting Brackets and N1 Speed Trim Box

A. Removal of EEC Mounting Brackets (Ref. Fig. 203)

(1) Pre-SB24013:

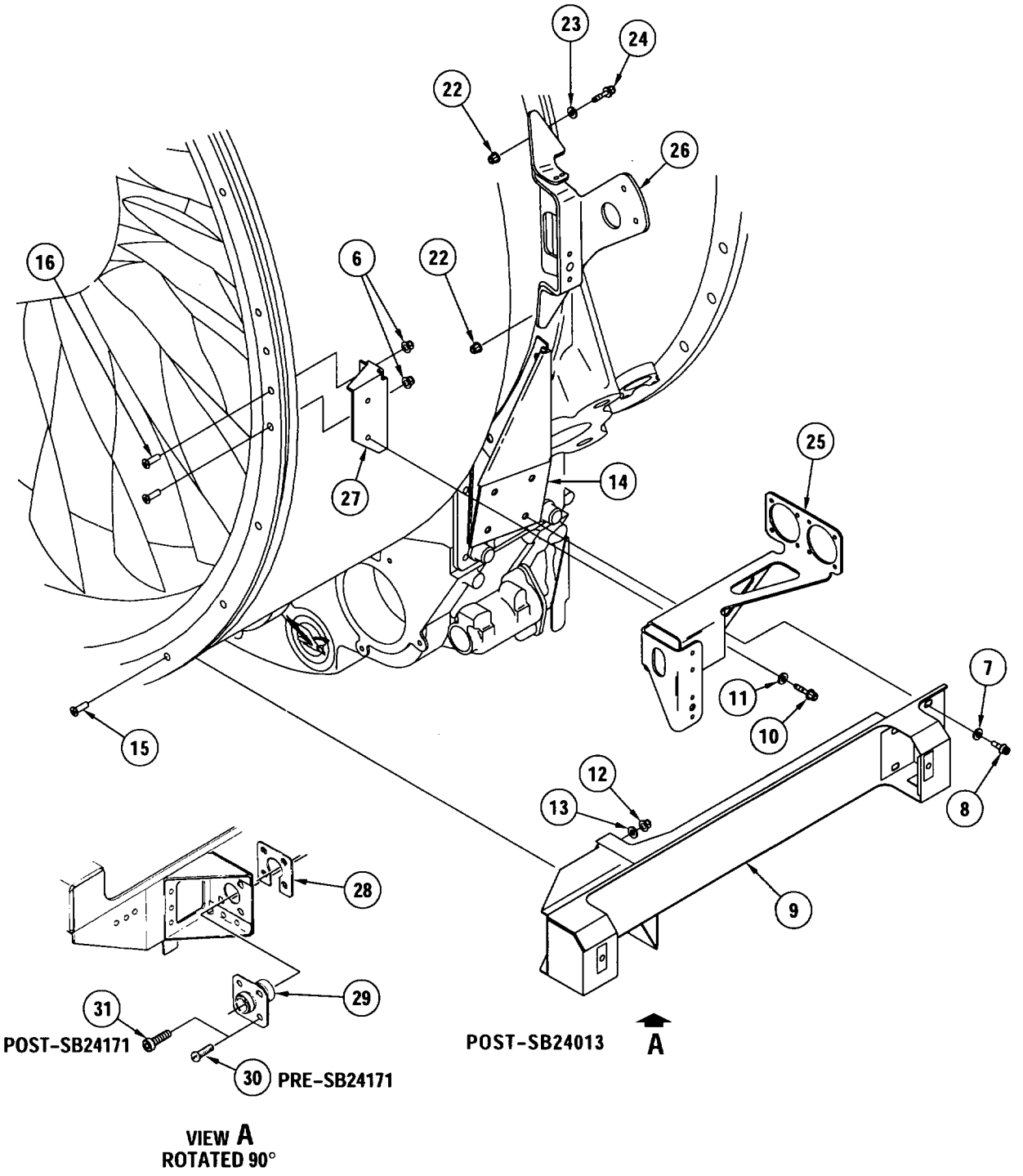


C20129B

Removal and Installation of EEC Mounting Brackets and N1 Speed Trim Box
Figure 203 (Sheet 1 of 3)

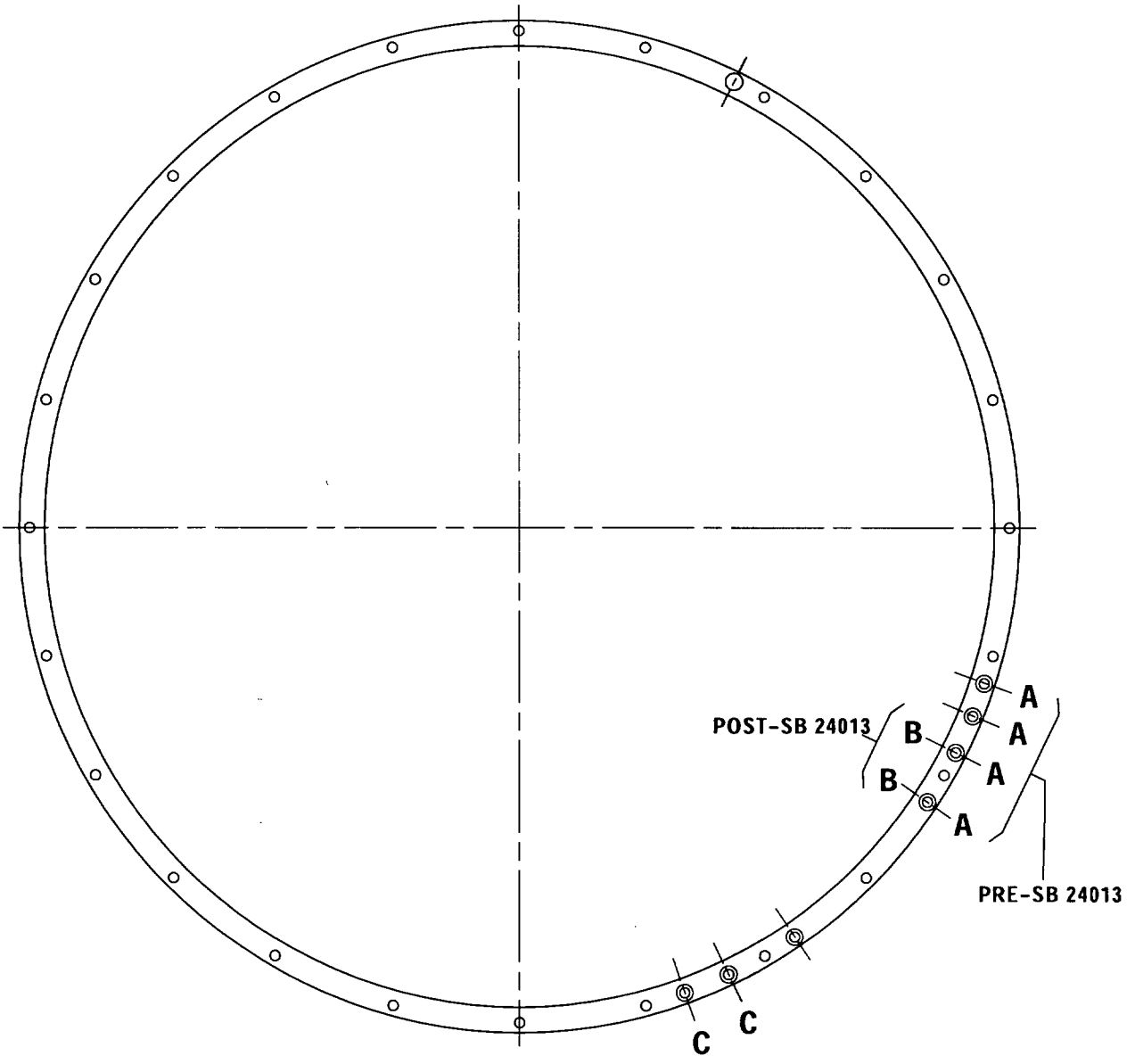
Key to Figure 203

1. Upper Rear Support Bracket Assembly (Pre-SB24013)
2. Flat Washer
3. Bolt
4. Bracket
5. Bolt
6. Upper Electrical Bracket Assembly (Pre-SB24013)
7. Flat Washer
8. Bolt
9. Lower Electrical Bracket Assembly
10. Bolt
11. Flat Washer
12. Nut
13. Flat Washer
14. Lower Rear Support Bracket Assembly
15. Screw
16. Screw
17. Harness Bracket Assembly (Pre-SB24013)
18. Flat Washer
19. Nut
20. Flat Washer
21. Nut
22. Nut
23. Washer
24. Bolt
25. Upper-front Support Bracket Assembly (Post-SB24013)
26. Upper-rear Bracket Assembly (Post-SB24013)
27. Front Support Bracket Assembly (Post-SB24013)
28. Multiple Self-locking Nut
29. N1 Speed Trim Box
30. Screw (Pre-SB24171)
31. Socket Head Cap Screw (Post-SB24171)



C32582B

Removal and Installation of EEC Mounting Brackets and N1 Speed Trim Box
Figure 203 (Sheet 2)



FLANGE A LOOKING REARWARD

C32575A

Removal and Installation of EEC Mounting Brackets and N1 Speed Trim Box
Figure 203 (Sheet 3)

(a) Remove three bolts (3) and washers (2) securing upper electrical bracket (6) to bracket (1) on Flange B.

(b) Support upper electrical bracket assembly (6) and remove two bolts (10) and washers (11). Remove upper electrical bracket from harness bracket assembly (17) and bracket (1).

(c) Remove nut (21), washer (20), bolt (5) and bracket (4) from upper electrical bracket.

(d) Remove two nuts (22), washers (23) and remove bracket (1) and one bolt (24).

(e) Remove four nuts (19), washers (18), screws (16) and harness bracket assembly (17) from Flange A.

(f) Remove two bolts (8) and washers (7) securing lower electrical bracket assembly (9) to bracket (14) on Flange B.

(g) Support lower electrical bracket assembly (9) and remove two nuts (12), washers (13) and screws (15). Remove lower electrical bracket assembly (9) from engine.

(h) Place all removed parts in sealable plastics bags and label with engine model, serial number, part number and date of storage.

(2) Post-SB24013 (Ref. Fig. 203, Sheet 2):

(a) Remove two nuts (22) and washer (23) and remove bracket (26) and one bolt (24).

(b) Remove two bolts (10) and two washers (11) and remove bracket (25).

(c) Remove two nuts (19) and remove bracket (27).

(d) Remove two bolts (8) and washers (7) securing lower electrical bracket assembly (9) to bracket (14) on Flange B.

(e) Support lower electrical bracket assembly (9) and remove two nuts (12), washers (13) and screws (15). Remove lower electrical bracket assembly (9) from engine.

(f) Place all removed parts in sealable plastic bags and label with engine model, serial number, part number and date of storage.

B. Removal of N1 Speed Trim Box (Ref. Fig. 203)

(1) Remove four screws (30) (Pre-SB24171) or cap screws (31) (Post-SB24171) and multiple self-locking nut (28).

(2) Remove N1 speed trim box (29). Identify and place in clean plastic bag.

C. Installation of EEC Mounting Brackets (Ref. Fig. 203)

(1) Pre-SB24013 (Ref. Fig. 203, Sheet 1):

(a) Install harness bracket assembly (17) on flange of fan case and secure with four screws (16), washers (18) and nuts (19) at Locations A. Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

(b) Install bracket (1) using one bolt (24), two washers (23) and two nuts (22). Torque nut on bolt 62 to 72 lb.in. (7.0-8.1 Nm). Torque nut on stud 54 to 60 lb.in. (6.0-7.0 Nm).

(c) Install upper electrical bracket assembly (6) to harness bracket assembly (17) and upper rear support bracket assembly (1). Secure bracket assembly (6) to bracket assembly (17) with two washers (11) and bolts (10), and to bracket (1) with three washers (2) and bolts (3). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm).

(d) Install lower electrical bracket assembly (9) to rear side of Flange A and to lower rear support bracket assembly (14). Secure bracket (9) to Flange A at Locations C with two screws (15), washers (13) and nuts (12), and to bracket (14) with four washers (7) and bolts (8). Torque nuts (12) and bolts (8) 36 to 40 lb.in. (4.0-4.6 Nm).

(e) Install angle bracket (4) on upper electrical bracket assembly (6) and secure with bolt (5), washer (20), and nut (21). Torque nut 36 to 40 lb.in. (4.0-4.6 Nm).

(2) Post-SB24013 (Ref. Fig. 203, Sheet 2):

(a) Install bracket (27) on Flange A of fan case at Location B and secure with two screws (16) and nuts (6). Torque nuts 36 to 40 lb.in. (4.1-4.5 Nm).

NOTE: Later versions of the fan case have only two holes at Location B instead of four holes per Location A.

(b) Install support bracket (25) on bracket (27) and secure with two bolts (10) and washers (11). Torque bolts 36 to 40 lb.in. (4.1-4.5 Nm).

(c) Install bracket (26) on Flange B and secure with one bolt (24), washer (23) and two nuts (22). Torque nuts 62 to 72 lb.in. (7.0-8.0 Nm). Torque nut on stud 54 to 60 lb.in. (6.0-7.0 Nm).

(d) Install lower electrical bracket assembly (9) to rear side of Flange A and to lower rear support bracket assembly (14). Secure bracket (9) to Flange A at Locations C with two screws (15), washers (13) and nuts (12), and to bracket (14) with four washers (7) and bolts (8). Torque nuts (12) and bolts (8) 36 to 40 lb.in. (4.0-4.6 Nm).

D. Installation of N1 Speed Trim Box (Ref. Fig. 203)

(1) Position N1 speed trim box (29) in EEC mounting bracket (9).

(2) Secure trim box using four screws (30) (Pre-SB24171) or cap screws (31) (Post-SB24171) and multiple self-locking nut (28).

(3) Torque screws (30) or (31) 6 to 7 lb.in. (0.7-0.8 Nm).

7. Ground Strap

A. Removal (Ref. Fig. 204)

(1) Remove ground strap attaching parts, as follows:

(a) Pre-SB24030: Remove bolt (10), nut (13) and washer (24) and separate clamp (6) and two rubber cushions (9) from bracket (12) and ground strap (14).

(b) Post-SB24030, Post-SB24053: Remove bolt (10) and nut (13); and separate clamp (6) and two rubber cushions (9) from bracket (22) and ground strap (21) or (23).

NOTE: Loop clamp (6) is relocated, to accommodate a shorter ground strap, by SB24053.

(c) Post-SB24120, Pre-SB24434: Remove bolt (10) and nut (13); and separate clamp (6) and two rubber cushions (9) from bracket (25) and ground strap (23).

(2) Post-SB24207: Remove bolt (10) and nut (13); separate clamp (6) and cushions (9) from bracket (25) and ground strap (23).

(3) Post-SB24254: Remove bolt (10) and nut (13); separate clamp (6) and cushions (9) from bracket (25) and ground strap (26).

(4) Post-SB24434: Remove bolt (10) and nut (13); separate clamp (6) and cushions (9) from bracket (29) and ground strap (26).

(5) Remove bolt (11) and bracket (12) (Pre-SB24030) or (22) (Post-SB24030).

(6) Remove strap end from EEC ground terminal.

(a) Pre-SB24030, Pre-SB24120: Remove nut (8) and washer (7) securing ground strap (14), to terminal (4). Remove washer (5).

(b) Post-SB24030, Pre-SB24120: Remove nut (8) and washer (7) securing strap (21).

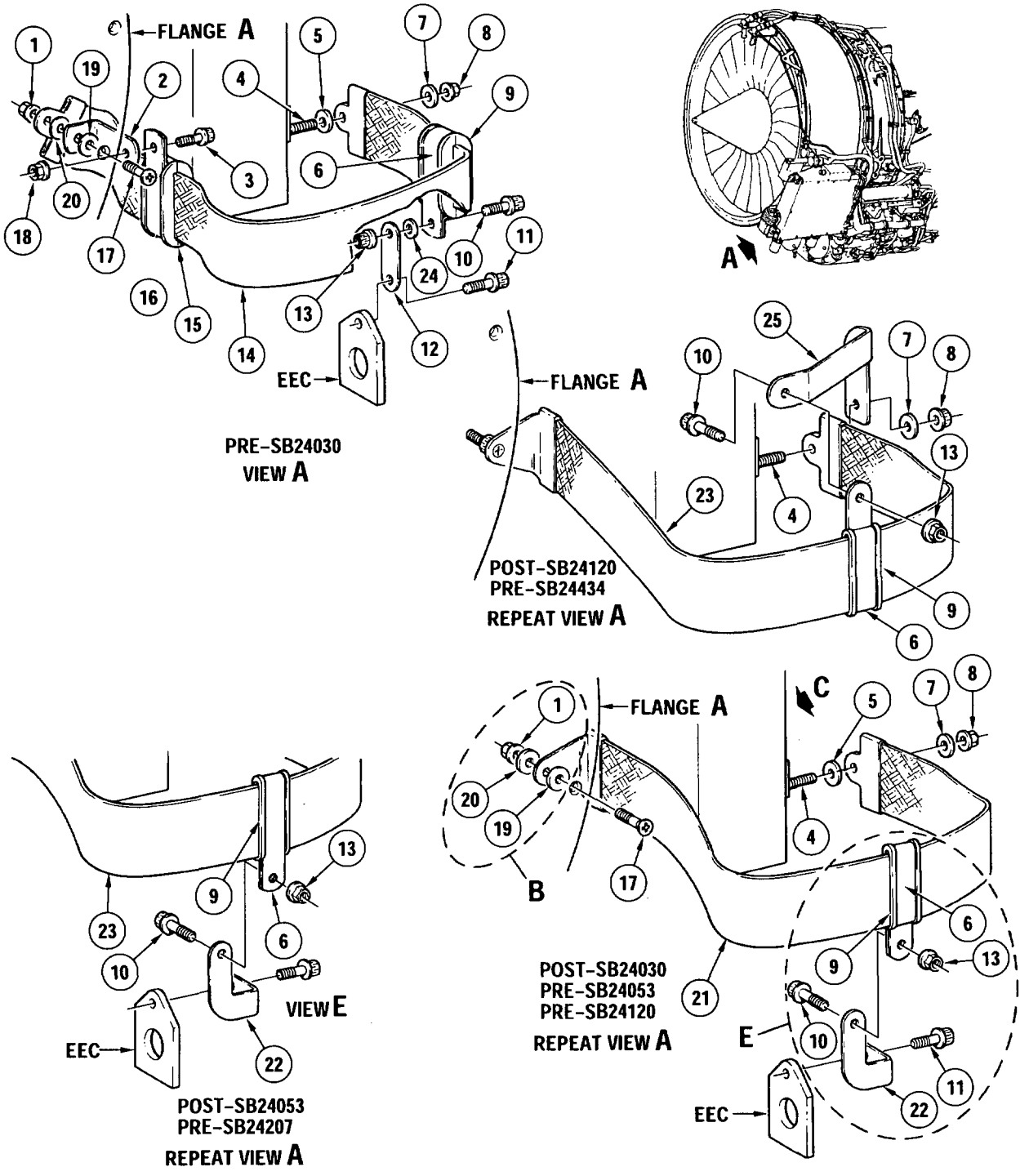
(c) Post-SB24120, Pre-SB24434: Remove nut (8), washer (7) and bracket (25) securing ground strap (23) to terminal (4).

(d) Post-SB24434: Remove nut (8), washer (7) and bracket (29) securing ground strap (26) to terminal (4).

(7) Remove strap end from Flange A.

(a) Pre-SB24030:

1 Remove nut (18) and bolt (3) from bracket (2) and loop clamp (16), and separate loop clamp (16) from strap (14).

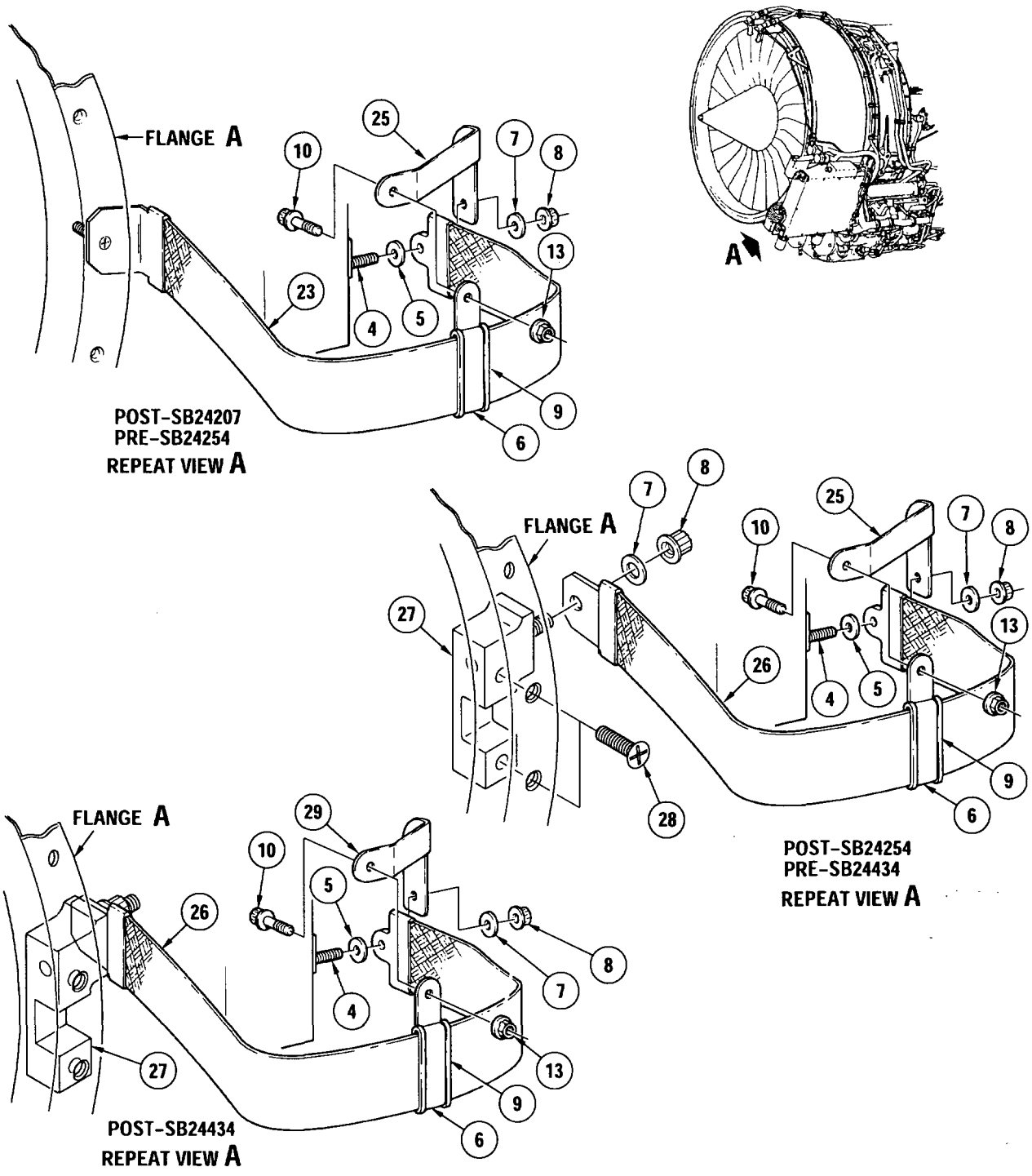


C21389B

Installation of EEC Braided Ground Cable Assembly
Figure 204 (Sheet 1 of 4)

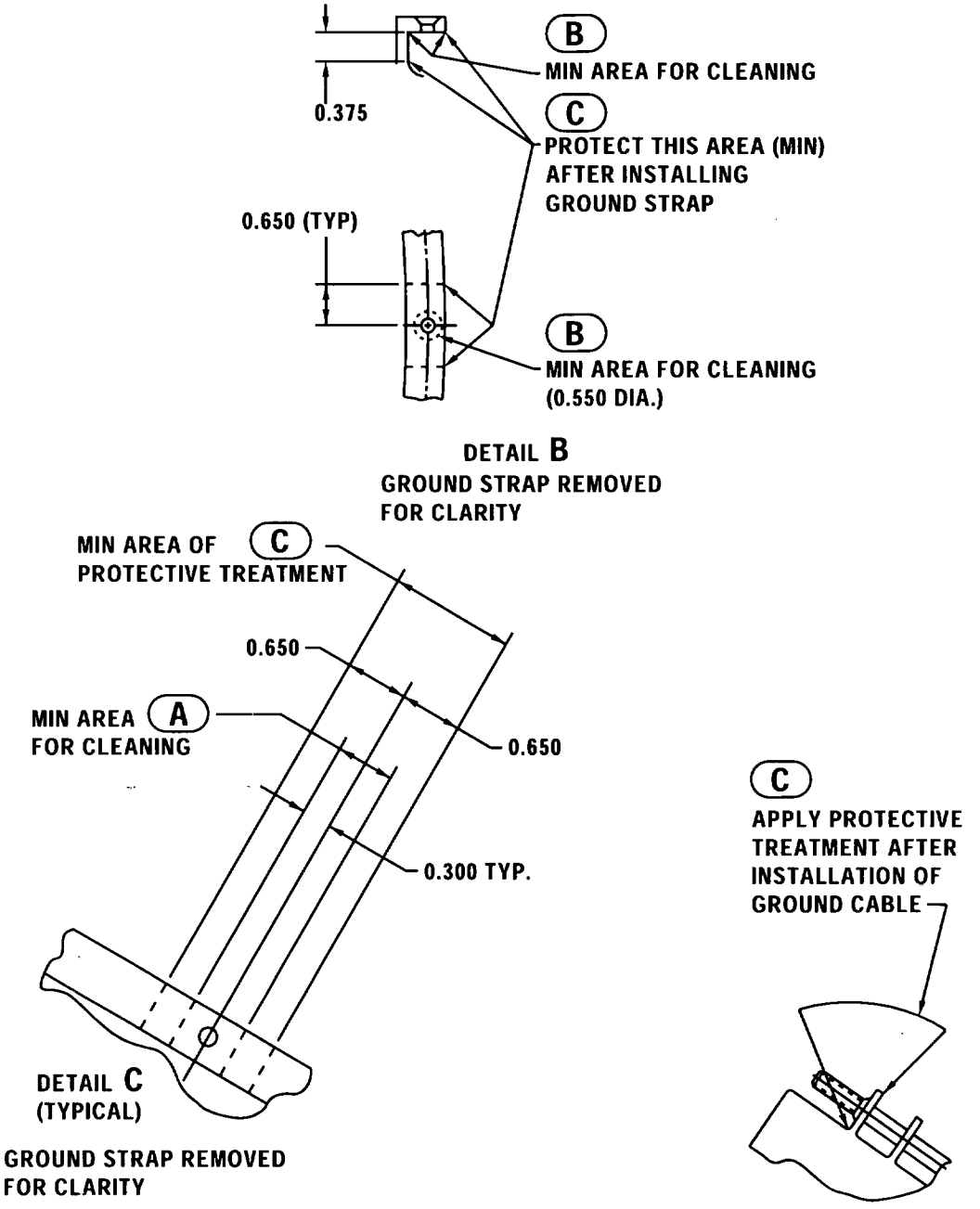
Key to Figure 204

1. Nut
2. Bracket (Pre-SB24030)
3. Bolt (Pre-SB24030)
4. Ground Terminal (integral with EEC)
5. Washer
6. Loop Clamp
7. Washer
8. Nut
9. Loop Clamp Cushion
10. Bolt
11. Bolt
12. Bracket (Pre-SB24030)
13. Nut
14. Ground Strap (Pre-SB24030)
15. Loop Clamp Cushion (Pre-SB24030)
16. Loop Clamp (Pre-SB24030)
17. Screw
18. Nut
19. Washer
20. Washer
21. Ground Strap (Post-SB24030)
22. Bracket (Post-SB24030)
23. Ground Strap (Post-SB24053, Post-SB24120)
24. Washer (Pre-SB24030)
25. Bracket (Post-SB24120, Post-SB24207, Post-SB24254)
26. Ground Strap (Post-SB24254, Post-SB24434)
27. Flange Support Plate Assembly (Post-SB24254, Post-SB24434)
28. Screw (Post-SB24254, Post-SB24434)
29. Bracket (Post-SB24434)



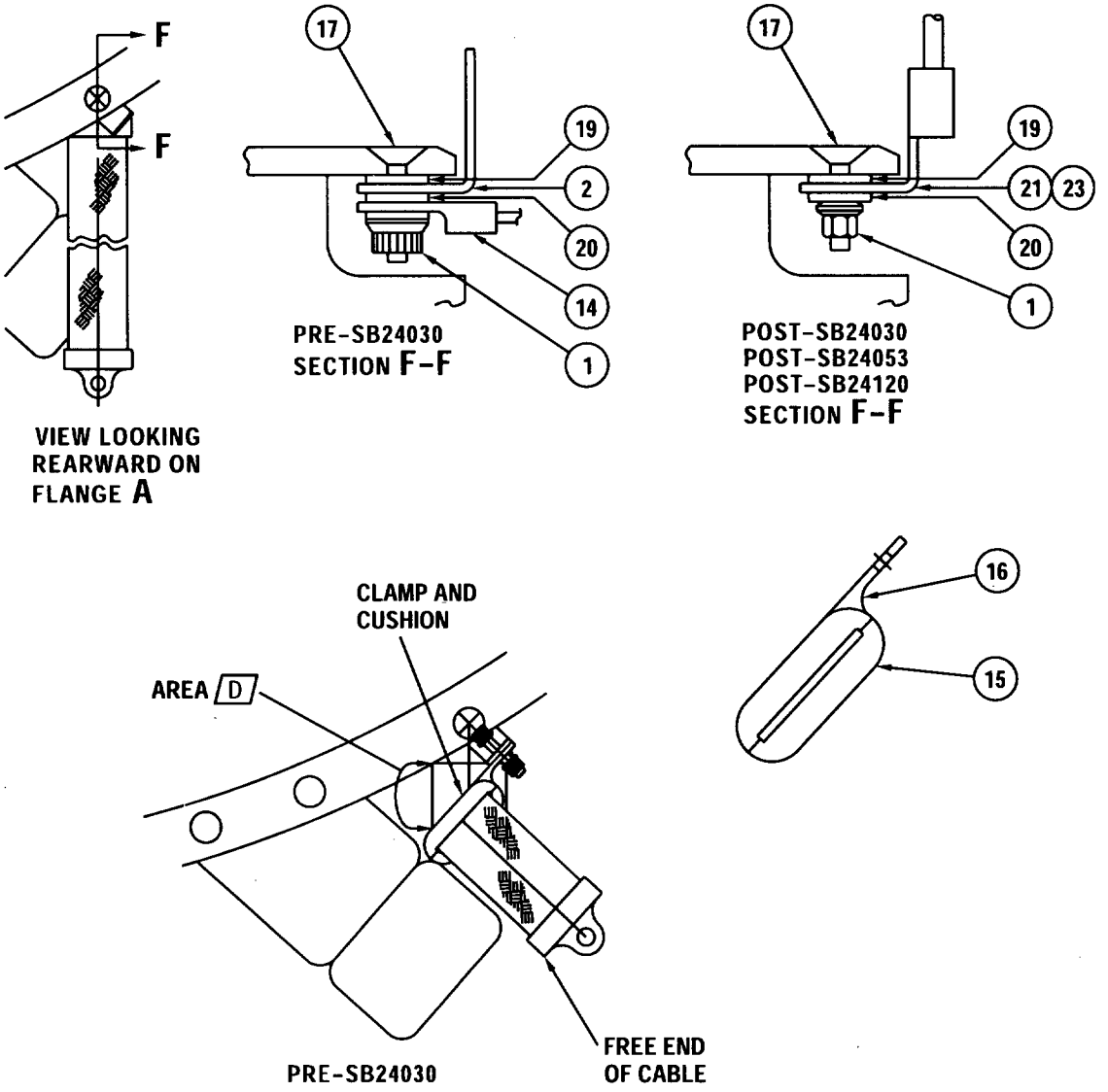
C106338

Installation of EEC Braided Ground Cable Assembly
Figure 204 (Sheet 2)



C32609

Installation of EEC Braided Ground Cable Assembly
Figure 204 (Sheet 3)



C32610

Installation of EEC Braided Ground Cable Assembly
Figure 204 (Sheet 4)

2 Remove nut (1), strap end, washer (20), bracket (2), washer (19) from rear face of Flange A. Remove screw (17).

(b) Post-SB24030, Post-SB24053, Post-SB24207: Remove nut (1), washer (20), end of strap (21) or (23), washer (19) from rear of Flange A. Remove screw (17).

(c) Post-SB24254, Post-SB24434: Remove nut (8), washer (7), and end of strap (26) from support plate assembly (27) on Flange A. Remove screws (28) and support plate assembly (27) from Flange A.

B. Installation (Ref. Fig. 204)

(1) Clean Areas A and B with petroleum solvent (PWC11-027).

(2) Install strap end to Flange A.

(a) Pre-SB24030:

1 Fit screw (17) to front face of Flange A. Install washer (19), bracket (2), washer (20), end of strap (14) to rear face of Flange A and secure nut (1) fingertight.

2 Fit cushions (15) and loop clamp (16) to strap and install loop clamp to bracket (2). Secure with bolt (3) and nut (18) fingertight.

3 Remove slack from Area D (Ref. Fig. 204, Sheet 4) of the cable by pulling free end of cable gently through cushion.

CAUTION: DO NOT PUT STRESS ON CABLE IN AREA D.

4 Torque nuts (1) and (18) 36 to 40 lb.in. (4.1-4.5 Nm).

(b) Post-SB24030, Post-SB24053, Post-SB24207: Fit end of strap (26) to screw (17) to front face of Flange A and install washer (19), end of strap (21), washer (20) and secure with nut (1). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(c) Post-SB24254, Post-SB24434:

1 Use screws (28) to secure support plate assembly (27) on Flange A.

2 Install nut (8), washer (7), and end of strap (26) on support plate assembly (27). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(3) Install strap end to EEC ground terminal.

(a) Fit washer (5) on terminal (4). Install end of ground strap (14) or (21) or (23) or (26) on terminal.

(b) Post-SB24030: Install washer (7) and secure with nut (8). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(c) Post-SB24120, Post-SB24207, Post-SB24254: Fit bracket (25), washer (7) and secure with nut (8). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(d) Post-SB24434: Fit bracket (29), washer (7) and secure with nut (8). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(4) Install ground strap attaching parts:

(a) Pre-SB24030: Fit cushion (9), loop clamp (6) on ground strap (14) and secure to flat bracket (12) with bolt (10), washer (24) and nut (13). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(b) Post-SB24030, Pre-SB24053, Pre-SB24120: Fit cushion (9), loop clamp (6) on ground strap (21) secure to bracket (22) with bolt (10) and nut (13). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(c) Post-SB24053: Fit cushion (9), loop clamp (6) on ground strap (23) secure to bracket (22) with bolt (10) and nut (13). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(d) Post-SB24120, Post-SB24207: Fit cushion (9), loop clamp (6) on ground strap (23) and secure to bracket (25) with bolt (10) and nut (13). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(e) Post-SB24254: Fit cushion (9), loop clamp (6) on ground strap (26) and secure to bracket (25) with bolt (10) and nut (13). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(f) Post-SB24434: Fit cushion (9), loop clamp (6) on ground strap (26) and secure to bracket (29) with bolt (10) and nut (13). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(g) Pre-SB24030 and Post-SB24030: Install bracket (12) or (22) on hinged EEC mounting bracket with bolt (11). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(5) Recheck torque of nuts (1, 8, 13) and bolt (11).

(6) Apply coat of silicone sealant (PWC09-001) on ground terminals at Areas C (Ref. Fig. 204, Sheet 3).

(7) For Pre-SB24531engines, apply a coat of silicone sealant (PWC09-001) on ground terminals at areas C (Ref. Fig. 204, Sheet 3).

(8) For Post-SB24531engines, apply coat of silicone sealant (PWC09-008 or PWC09-008A) on ground terminals at areas C (Ref. Fig. 204, Sheet 3).

8. Trim Plug

A. Removal (Ref. Fig. 205)

CAUTION: MAKE SURE AIRFRAME 28 VDC POWER IS OFF WHEN DISCONNECTING ELECTRICAL CONNECTORS.

(1) Record the class of the trim plug to be removed. The new plug must be the same class for T4.5 and N1 trim.

(2) Remove bolt (1) from retaining strap.

(3) Remove trim plug (2).

(4) Install protective cap on EEC connector.

B. Installation (Ref. Fig. 205)

CAUTION: MAKE SURE AIRFRAME 28 VDC POWER IS OFF WHEN CONNECTING ELECTRICAL CONNECTORS.

CAUTION: MAKE SURE THE CLASS OF REPLACEMENT TRIM PLUG IS THE SAME AS THE ONE REMOVED.

CAUTION: MAKE SURE CONNECTOR PLUG IS FREE FROM MOISTURE; IF NECESSARY, DRY USING HEAT GUN.

(1) Remove protective cap.

(2) Apply electrical contact enhancer to connectors (Ref. 70-00-00, CLEANING).

CAUTION: USE ONLY APPROVED TOOLS TO TIGHTEN TRIM PLUG CONNECTOR. CONNECTOR IS PROPERLY TIGHTENED WHEN ONLY THE BLUE COLOR BAND IS VISIBLE; RED COLOR BAND MUST NOT BE VISIBLE.

(3) Install trim plug (2) on EEC. Tighten trim plug using pliers (PWC90012).

(4) Post-SB24507 or Post-SB24372: Apply electrical insulation tape to connector (Ref. 70-00-00, REMOVAL/INSTALLATION).

(5) Install bolt (1) and torque 36 to 40 lb.in. (4.1-4.5 Nm).

(6) Select airframe 28 VDC power ON.

(7) Make sure no EEC fault lamps are on.

(8) If fault lamps are on, refer to 72-00-00, FAULT ISOLATION.

(9) Do a Check No. 2 - Engine Start, followed by a Check No. 3 - Engine Shutdown (Ref. 71-00-00, ADJUSTMENT/TEST).

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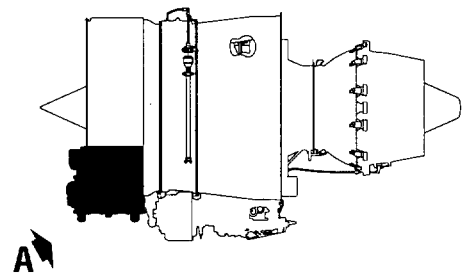
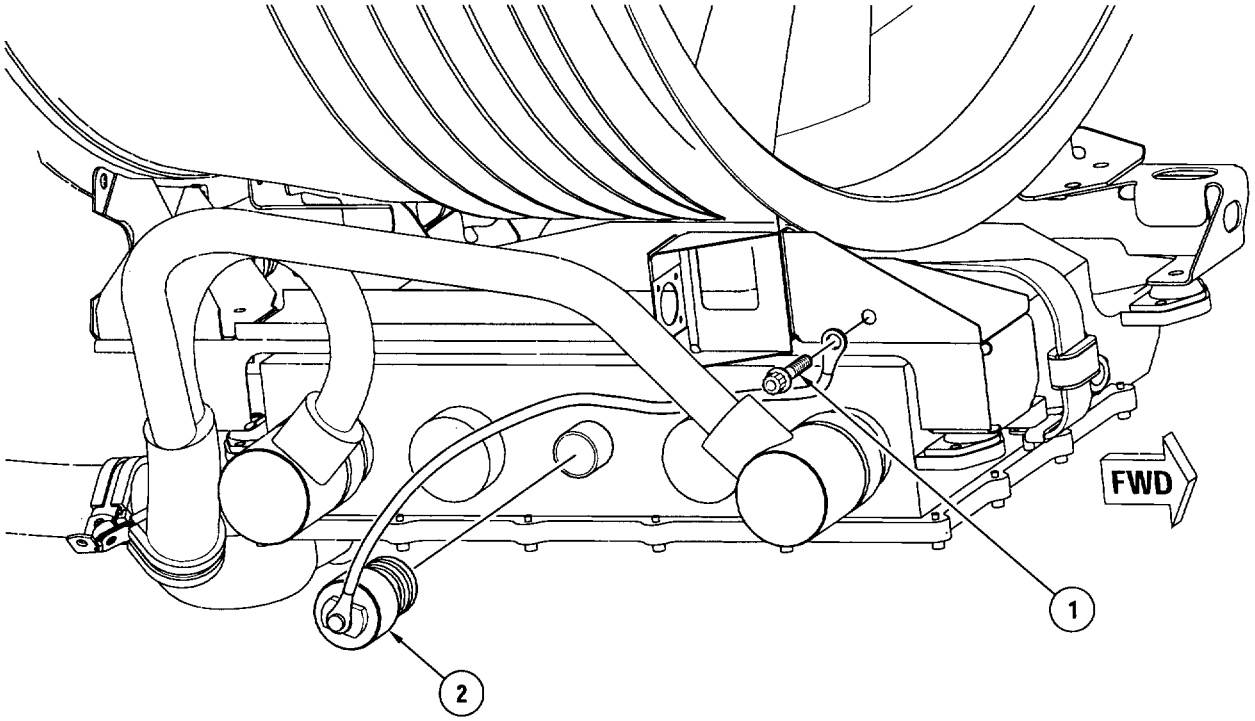




VIEW A

C75031

Trim Plug - Removal/Installation
Figure 205

Key to Figure 205

1. Bolt
2. Trim Plug

WIRING HARNESSES - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   Not Applicable

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC60142-100	Wrench
PWC60142-200	Wrench

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Outer Wiring Harness

   A. Removal (Ref. Fig. 201)

   CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN REMOVING CONNECTORS.

   (1) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).

   (2) Disconnect connectors P22 and P23.

   (3) Remove two nuts (3), bolts (2) and loop clamps (4).

   (4) Remove five bolts (2) and loop clamps (4).

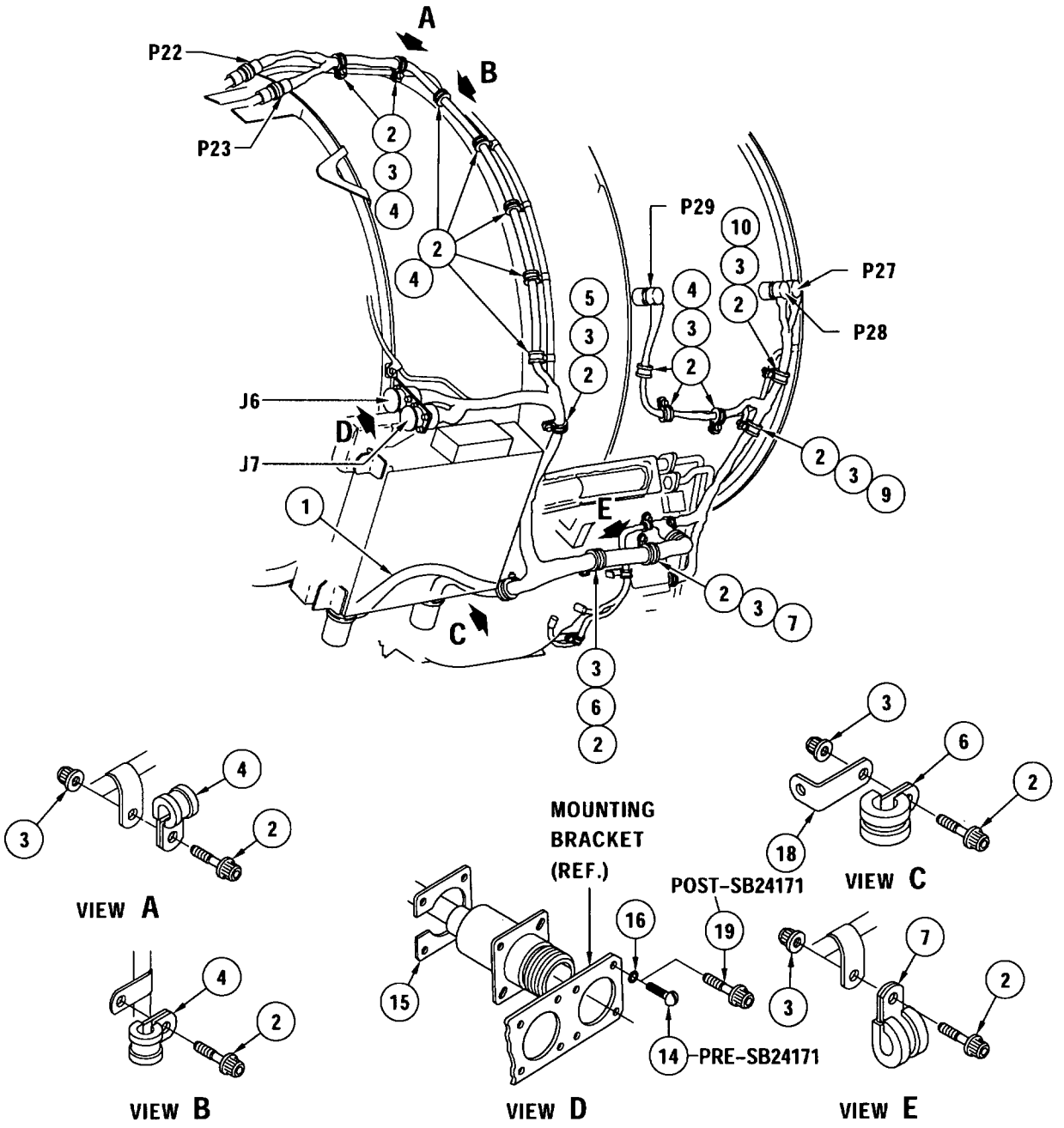
   (5) Remove eight screws (14) (Pre-SB24171) or cap screws (Post-SB24171), washers (16) and two multiple nut plates (15) securing connectors J6 and J7 to mounting bracket. Remove connectors J6 and J7.

   (6) Remove nut (3), bolt (2) and loop clamp (5).

   (7) Remove nut (3), bolt (2) and loop clamp (6) from bracket (18).

   (8) Disconnect connectors P1 and P4 from EEC. Disconnect P31 from trim box.

   (9) Disconnect connectors P27, P28, and P29.



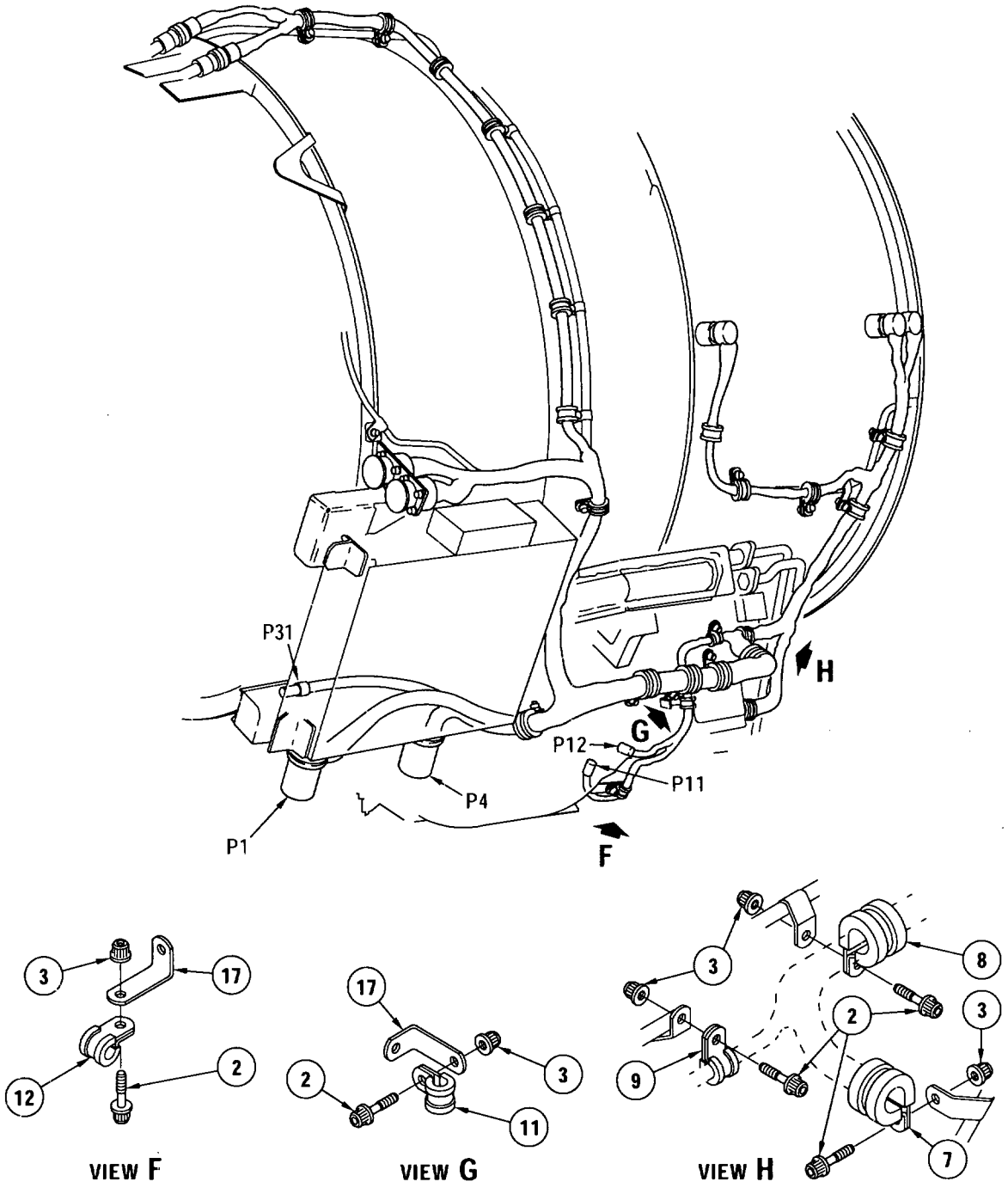
C31370E

Outer Electrical Wiring Harness - Removal/Installation
Figure 201 (Sheet 1 of 6)

Key to Figure 201

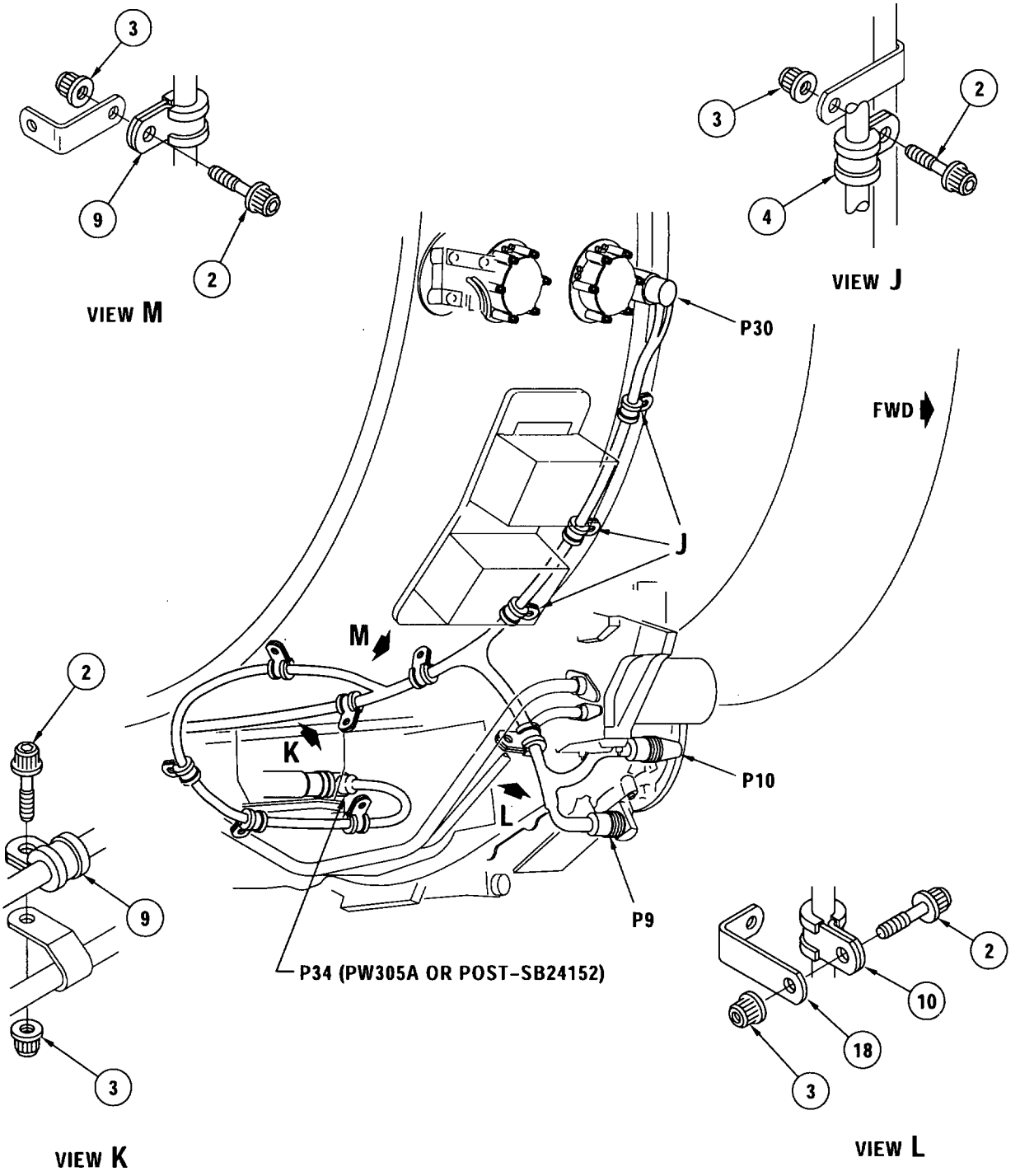
1. Outer Wiring Harness
2. Bolt
3. Self-locking Nut
4. Loop Clamp
5. Loop Clamp
6. Loop Clamp
7. Loop Clamp
8. Loop Clamp
9. Loop Clamp
10. Loop Clamp
11. Loop Clamp
12. Loop Clamp
13. Loop Clamp
14. Screw (Pre-SB24171)
15. Self-locking Nut
16. Flat Washer
17. Angle Bracket
18. Angle Bracket
19. Socket Head Cap Screw (Post-SB24171)
20. Washer (Post-SB24309)
21. Angle Bracket (Post-SB24152 and Pre-SB24309)
22. Self-locking Nut (Post-SB24152 and Pre-SB24309)
23. Loop Clamp (Post-SB24152 and Pre-SB24309)
24. Bolt (Post-SB24152 and Pre-SB24309)
25. Nut
26. Loop Clamp (Post-SB24152 and Pre-SB24309)
27. Bolt (Post-SB24152 and Pre-SB24309)
28. Nut (Post-SB24152 and Pre-SB24309)
29. Bolt (Post-SB24152 and Pre-SB24309)
30. Washer (Post-SB24152 and Pre-SB24309)
31. Bolt (Post-SB24152 and Pre-SB24309)
32. Bracket (Post-SB24152 and Pre-SB24309)
33. Nut (Post-SB24152 and Pre-SB24309)
34. Loop Clamp (Post-SB24152 and Pre-SB24309)
35. Loop Clamp (Post-SB24152 and Pre-SB24309)
36. Washer (Post-SB24152 and Pre-SB24309)
37. Nut (Post-SB24152 and Pre-SB24309)
38. Bolt (Post-SB24309)
39. Nut (Post-SB24309)
40. Loop Clamp (Post-SB24309)
41. Loop Clamp (Post-SB24309)
42. Outer Wiring Harness (Post-SB24309)

P&WC Proprietary Information. Subject to the restrictions on the title page.



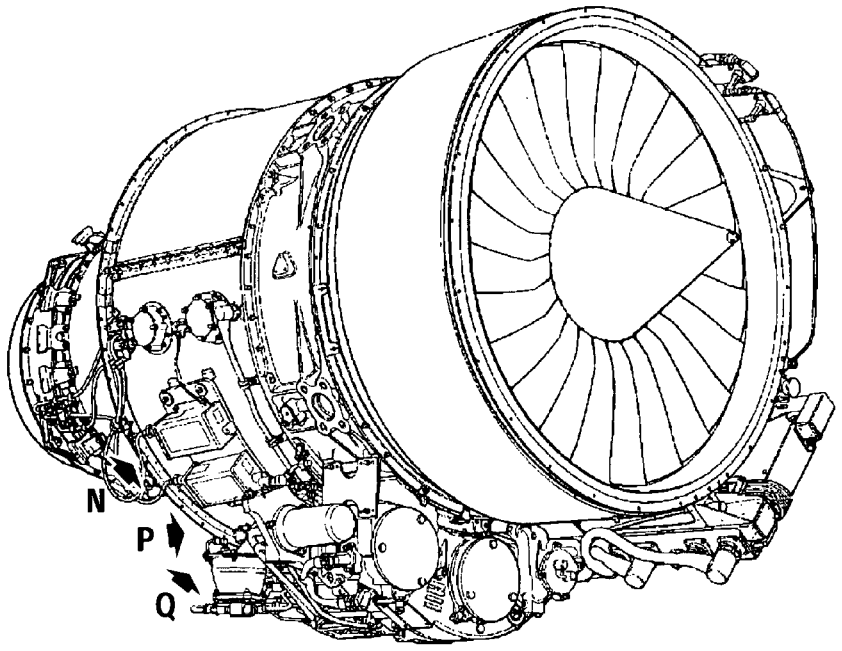
C31369A

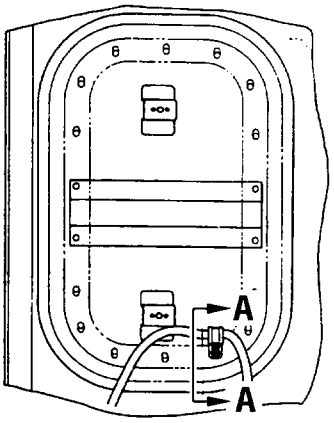
Outer Electrical Wiring Harness - Removal/Installation
Figure 201 (Sheet 2)



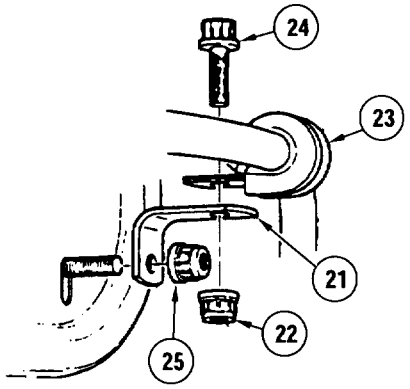
C31371A

Outer Electrical Wiring Harness - Removal/Installation
Figure 201 (Sheet 3)

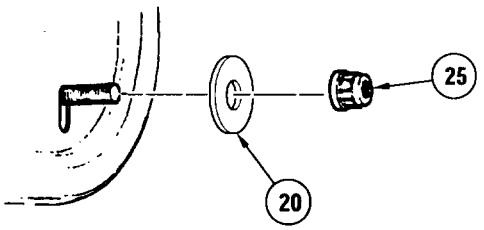




VIEW N
IGNITOR BOXES NOT
SHOWN FOR CLARITY



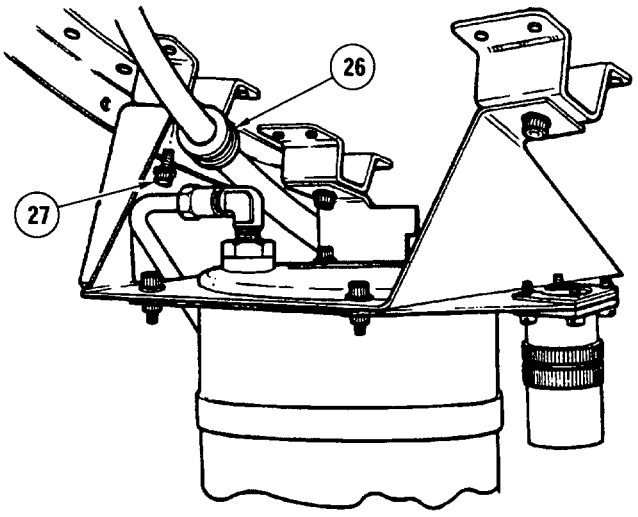
SECTION A–A
Post–SB24152
Pre–SB24309



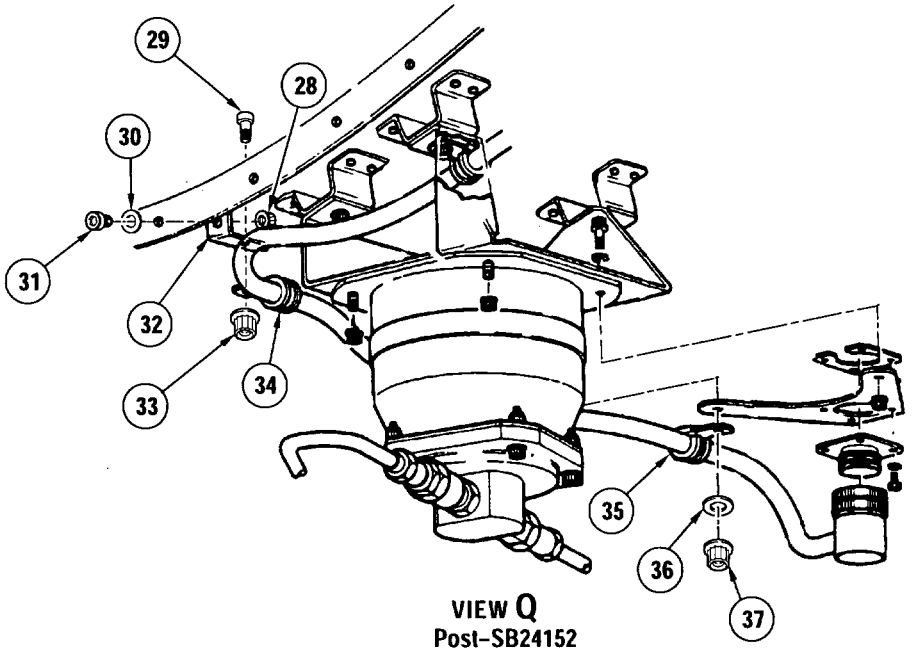
SECTION A–A
Pre–SB24152
Post–SB24309

C110389

Outer Electrical Wiring Harness - Removal/Installation
Figure 201 (Sheet 4)



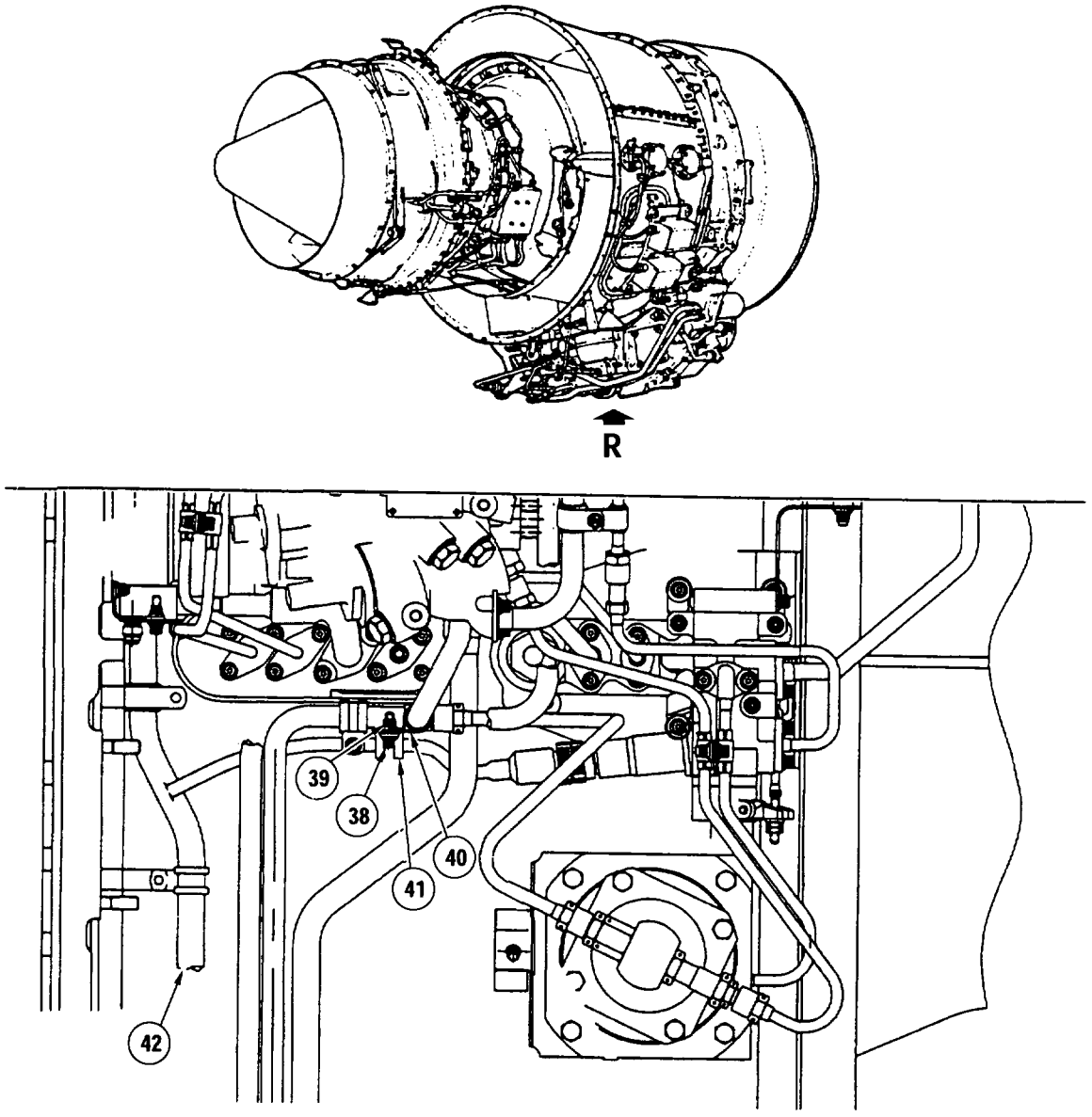
VIEW P
Post-SB24152
Pre-SB24309



VIEW Q
Post-SB24152
Pre-SB24309

C110390

Outer Electrical Wiring Harness - Removal/Installation
Figure 201 (Sheet 5)



VIEW R (ASSEMBLED)
Post-SB24309

C110391

Outer Electrical Wiring Harness - Removal/Installation
Figure 201 (Sheet 6)

(10) Post-SB24434: Disconnect connector P39.

(11) Disconnect connectors P15, P16 and P17.

(12) Remove nut (3), bolt (2) and loop clamp (10).

(13) Remove three nuts (3), bolts (2) and loop clamps (4).

(14) Pre-SB24434: Remove nut (3), bolt (2) and loop clamp (9).

(15) Post-SB24434: Remove nut (3), bolt (2) and loop clamps (4) and (9).

(16) Remove three nuts (3), bolts (2) and loop clamps (7, 8 and 9).

(17) Remove two nuts (3), bolts (2) and loop clamps (7).

(18) Remove nut (3), bolt (2) and loop clamp (6).

(19) Disconnect connectors P11 and P12.

(20) Remove two nuts (3), bolts (2) and loop clamps (11 and 12).

(21) Remove connectors P9, P10 and P30.

(22) PW305A or Post-SB24152:

  (a) Disconnect P34 connector.

(23) Remove two nuts (3), bolts (2) and loop clamps (9).

(24) Remove nut (3), bolt (2) and loop clamp (10).

(25) Remove three nuts (3), bolts (2) and loop clamps (4).

(26) Post-SB24152 and Pre-SB24309:

  (a) Remove nut (25), bracket (21), bolt (24), nut (22) and loop clamp (23) (Ref. Section A-A).

  (b) Remove nut, bolt (27) and loop clamp (26) (Ref. View P).

  (c) Remove nut (28), bolt (31), washer (30), nut (33), bolt (29), bracket (32) and loop clamp (34) (Ref. View Q).

  (d) Remove nut (37), washer (36), bolt and loop clamp (35).

(27) Post-SB24309: Remove nut (39), bolt (38) and loop clamps (40 and 41) (Ref. View R).

(28) Remove wiring harness from the engine.

CAUTION: INSTALL PROTECTIVE CAPS OVER THE OUTSIDE OF ELECTRICAL CONNECTORS. DO NOT INSTALL PROTECTIVE CAPS ON THE INSIDE OF ELECTRICAL CONNECTOR SLEEVES. IMPROPER INSTALLATION OF CAP CAN DAMAGE THE INSIDE OF THE CONNECTOR (Ref. 70-00-00, REMOVAL/INSTALLATION).

(29) Place protective covers on all connectors and receptacles.

(30) Place wiring harness and attaching hardware in sealable plastic bags and tag with engine model, serial number, wiring harness part number and date of storage.

B. Installation (Ref. Fig. 201)

CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN INSTALLING CONNECTORS.

CAUTION: DO NOT FORCE OR STRETCH HARNESS WHEN INSTALLING CONNECTORS OR FASTENING LOOP CLAMPS.

CAUTION: USE ONLY APPROVED TOOLS TO TIGHTEN WIRING HARNESS CONNECTORS. THE CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY THE BLUE COLOR BAND IS VISIBLE. THE RED COLOR BAND MUST NOT BE VISIBLE.

(1) Apply electrical contact enhancer to connectors (Ref. 70-00-00, CLEANING).

(2) Position wiring harness on intermediate case and connect connectors P22 and P23 to receptacles at front of intermediate case. Torque connectors 24 to 29 lb.in. (2.7-3.3 Nm) using wrench (PWC60142-100).

(3) Install two loop clamps (4) at location A on wiring harness (1) and secure to J brackets with bolts (2) and nuts (3). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

(4) Install five loop clamps (4) at location B on wiring harness and secure to J brackets on pressure oil tube with bolts (2). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(5) Position connectors J6 and J7 on electrical mounting bracket and secure with eight washers (16), eight screws (14) (Pre-SB24171) or cap screws (19) (Post-SB24171) and two nut plates (15). Torque screws 7 to 8 lb.in. (0.8-1.0 Nm).

(6) Position loop clamp (5) on wiring harness and secure to bracket with bolt (2) and nut (3). Torque nut 36 to 40 lb.in. (4.0-4.6 Nm).

(7) Install connectors P1 and P4 to EEC. Install connector P31 to trim box. Torque connectors P1 and P4 99 to 104 lb.in. (11.2-11.7 Nm) using wrench (PWC60142-200). Torque connector P31 24 to 29 lb.in. (2.7-3.3 Nm) using wrench (PWC60142-100).

(8) Install connectors P15, P16 and P17 to HMU. Torque connectors 21 to 26 lb.in. (2.4-2.9 Nm) using wrench (PWC60142-100).

(9) Position loop clamps (6) on wiring harness at two places. Secure to bracket at EEC and to bracket (18) with bolts (2) and nuts (3). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

(10) Position two loop clamps (7) on wiring harness and secure to J brackets with bolts (2) and nuts (3). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

(11) Position loop clamps (7, 8 and 9) on wiring harness at location H and secure to J brackets with bolts (2) and nuts (3). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

(12) Install connectors P11 and P12 to their respective receptacles. Torque connectors 21 to 26 lb.in. (2.4-3.0 Nm) using wrench (PWC60142-100).

(13) Position loop clamps (11 and 12) on wiring harness and secure to brackets (17) (Ref. Views G and F) with bolts (2) and nuts (3). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

(14) Install connectors P27, P28 and P29. Torque connectors 30 to 35 lb.in. (3.4-4.0 Nm) using wrench (PWC60142-100).

(15) Position loop clamps (4, 9 and 10) on wiring harness and secure to J brackets with bolts (2) and nuts (3). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

(16) Install connectors P9, P10 and P30. Torque connectors 30 to 35 lb.in. (3.4-4.0 Nm) using wrench (PWC60142-100).

(17) Install connector P34 to start fuel and dump valve. Torque connector 24 to 29 lb.in. (2.8-3.3 Nm) using wrench (PWC60142-100).

(18) Post-SB24152 and Pre-SB24309:

(a) Install bracket (21), nut (25), loop clamp (23), bolt (24) and nut (22) (Ref. Section A-A).

(b) Install loop clamp (26), bolt (27) and nut (Ref. View P).

(c) Install bracket (32), washer (30), bolt (31), nut (28), loop clamp (34), bolt (29) and nut (33) (Ref. View Q).

(d) Install loop clamp (35), bolt, washer (36) and nut (37).

(19) Post-SB24309: Install clamps (40 and 41), bolt (38) and nut (39) (Ref. View R).

(20) Position three loop clamps (4) at locations J and secure to J brackets with bolts (2) and nuts (3). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

(21) Position loop clamps (9) on wiring harness and secure at locations K and M with bolts (2) and nuts (3). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

(22) Position loop clamp (10) on wiring harness and secure to bracket (18) at location L with bolt (2) and nut (3). Torque nut 36 to 40 lb.in. (4.0-4.6 Nm).

(23) Post-SB24507 or Post-SB24372: Apply electrical insulation tape to P1, P4, P15, P16, P11 and P12 connectors (Ref. 70-00-00, REMOVAL/INSTALLATION).

(24) Restore electrical power to the appropriate system and reset EEC circuit breaker to ON.

(25) Select maintenance test discrete OFF (Ref. Aircraft Maintenance Manual).

(26) Refer to Chapter 71-00-00 for checks following installation of wiring harness.

(27) Pull EEC circuit breaker to OFF.

6. Core Wiring Harness

A. Removal of Rear Core Wiring Harness (Ref. Fig. 202)

CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN REMOVING CONNECTORS.

(1) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).

(2) Disconnect rear core wiring harness N1 OUT connectors (22) from N1/T4.5 terminal box (33) (Ref. 77-20-01).

(3) Remove two bolts (6) (Ref. View D) and two self-locking nuts (2) from bracket (1). Remove loop clamps (3, 4 and 5) from wiring harness (22).

(4) Remove two self-locking nuts (25 and 27) (Ref. View B), two bolts (29 and 32) and bracket (31). Remove loop clamps (24, 26, 28 and 30) from rear core wiring harness (22).

(5) Remove self-locking nut (8) (Ref. View D) and bolt (13) from bracket (7). Remove loop clamps (9, 10, 11 and 12) from wiring harness (22).

(6) Remove eight screws (18) (Ref. View A) (Pre-SB24171) or cap screws (Post-SB24171), eight washers (17) and two nut plates (14) from two terminal connectors (15). Remove two gaskets (16).

(7) Remove two bolts (19) and remove wiring harness (22) from engine.

(8) Remove two bolts (20) and two self-locking nuts (35) securing bracket (21) to wiring harness.

CAUTION: INSTALL PROTECTIVE CAPS OVER THE OUTSIDE OF ELECTRICAL CONNECTORS. DO NOT INSTALL PROTECTIVE CAPS ON THE INSIDE OF ELECTRICAL CONNECTOR SLEEVES. IMPROPER INSTALLATION OF CAP CAN DAMAGE THE INSIDE OF THE CONNECTOR (Ref. 70-00-00, REMOVAL/INSTALLATION).

(9) Place protective covers on all connectors and receptacles.

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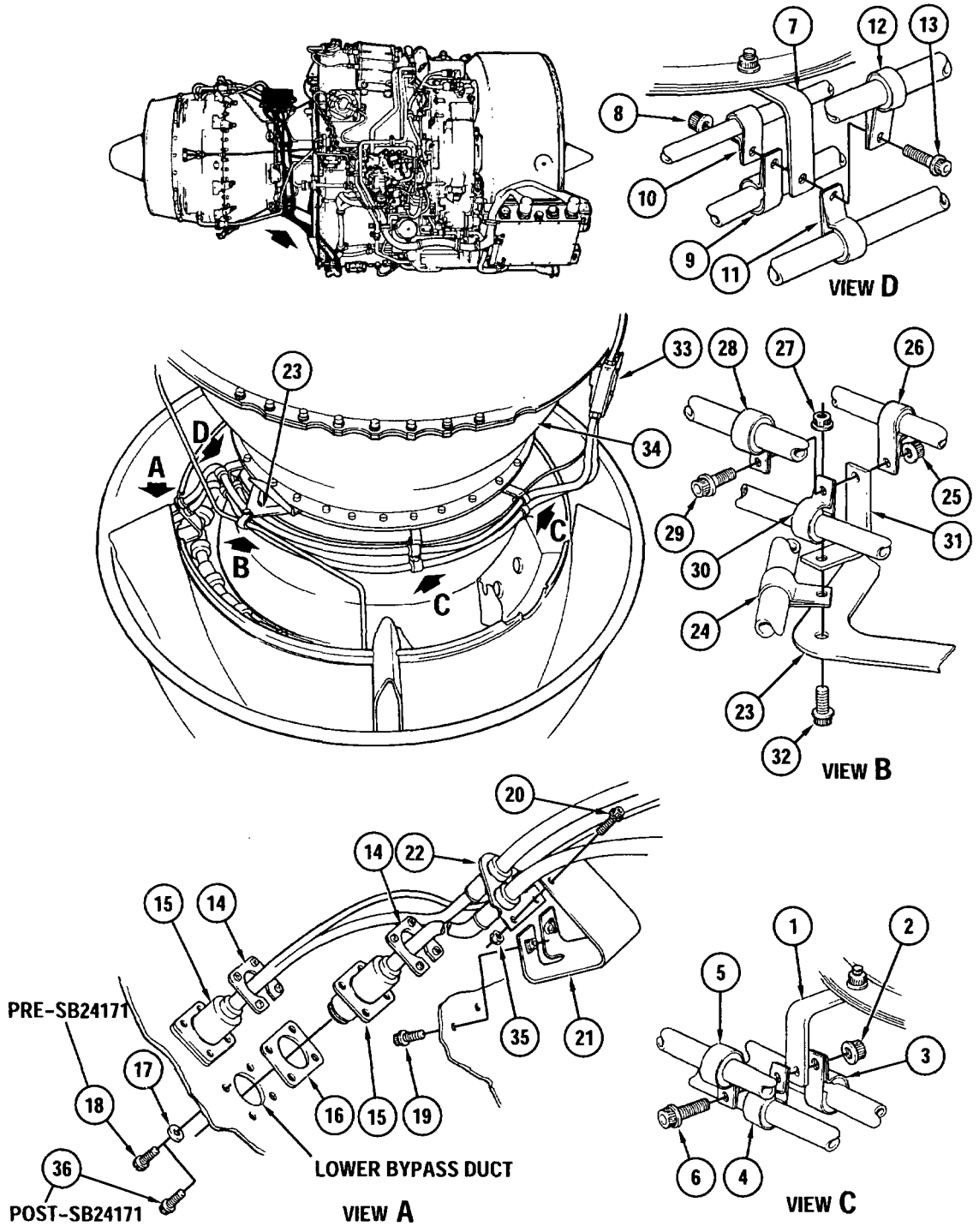

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Rear Core Wiring Harness - Removal/Installation
Figure 202

Key to Figure 202

1. Bracket (Ref.)
2. Self-locking Nut
3. Loop Clamp
4. Loop Clamp
5. Loop Clamp
6. Bolt
7. Bracket (Ref.)
8. Self-locking Nut
9. Loop Clamp
10. Loop Clamp
11. Loop Clamp
12. Loop Clamp
13. Bolt
14. Nut Plate
15. J27 Connector
16. Gasket
17. Washer
18. Screw (Pre-SB24171)
19. Bolt
20. Bolt
21. Bracket Assembly
22. Rear Core Harness
23. Bracket
24. Loop Clamp
25. Self-locking Nut
26. Loop Clamp
27. Self-locking Nut
28. Loop Clamp
29. Bolt
30. Loop Clamp
31. Bracket
32. Bolt
33. Terminal Box
34. LP Turbine Module (Ref.)
35. Self-locking Nut
36. Cap Screw (Post-SB24171)

B. Installation of Rear Core Wiring Harness (Ref. Fig. 202)

CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN INSTALLING CONNECTORS.

CAUTION: DO NOT FORCE OR STRETCH HARNESS WHEN INSTALLING CONNECTORS OR FASTENING LOOP CLAMPS.

CAUTION: TIGHTEN CONNECTORS WITH APPROVED TOOL ONLY. CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY THE BLUE COLOR BAND IS VISIBLE.

(1) Apply electrical contact enhancer to connectors (Ref. 70-00-00, CLEANING).

(2) Secure bracket assembly (21) to rear core harness (22) using two bolts (20) and two self-locking nuts (35). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(3) Install two gaskets (16) (Ref. View A) on two terminal connectors (15) and position wiring harness on engine. Secure wiring harness (22) to rear support ring using two bolts (19). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(4) Secure two terminal connectors (15) to lower bypass duct using eight washers (17) and eight screws (18)(Pre-SB24171) or cap screws (Post-SB24171). Torque 6.0 to 7.0 lb.in. (0.6-0.8 Nm).

(5) Install loop clamps (9, 11 and 12) (Ref. View C) on wiring harness and clamp (10) (part of T4.5 wiring harness). Secure loop clamps to bracket (7) and clamp (10) (part of T4.5 wiring harness) using bolt (13) and self-locking nut (8). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(6) Secure loop clamp (24) (Ref. View B) and bracket (31) to bracket (23) using bolt (32) and self-locking nut (27). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(7) Install loop clamp (26, 28 and 30) on wiring harness and secure to bracket (31) using bolt (29) and self-locking nut (25). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(8) Position loop clamp (3, 4 and 5) (Ref. View D) on wiring harness and secure to bracket (1) using bolt (6) and self-locking nut (2). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(9) Install rear core wiring harness (22) in N1/T4.5 terminal box (33) (Ref. 77-20-01).

(10) Restore electrical power to appropriate system and reset EEC circuit breaker to ON.

(11) Select maintenance discrete OFF.

(12) Pull EEC circuit breaker to OFF.

C. Removal of Front Core Wiring Harness (Ref. Fig. 203)

CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN REMOVING CONNECTORS.

(1) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).

(2) Remove upper (outer and inner) bypass ducts (Ref. 72-70-01).

(3) Remove bolt (15) and loop clamp (17).

(4) Pre-SB24298: Remove four cap screws (18), washers (19) and nut plate (21) (Ref. View C). Remove J29 connector (16) from left outer bypass duct. Remove and discard gasket (20).

(5) Post-SB24298: Remove two bolts (38), two washers (37) and bracket (36) (Ref. View C). Remove J29 connector (16) from left outer bypass duct. Remove and discard gasket (20).

(6) Remove two self-locking nuts (22), four bolts (14) and four loop clamps (12).

(7) Remove self-locking nut (10), bolt (26) and loop clamp (8).

(8) Remove self-locking nut (2) (Ref. View A) and loop clamp (4) from harness (1).

(9) Remove two self-locking nuts (25), two bolts (28) and two loop clamps (27).

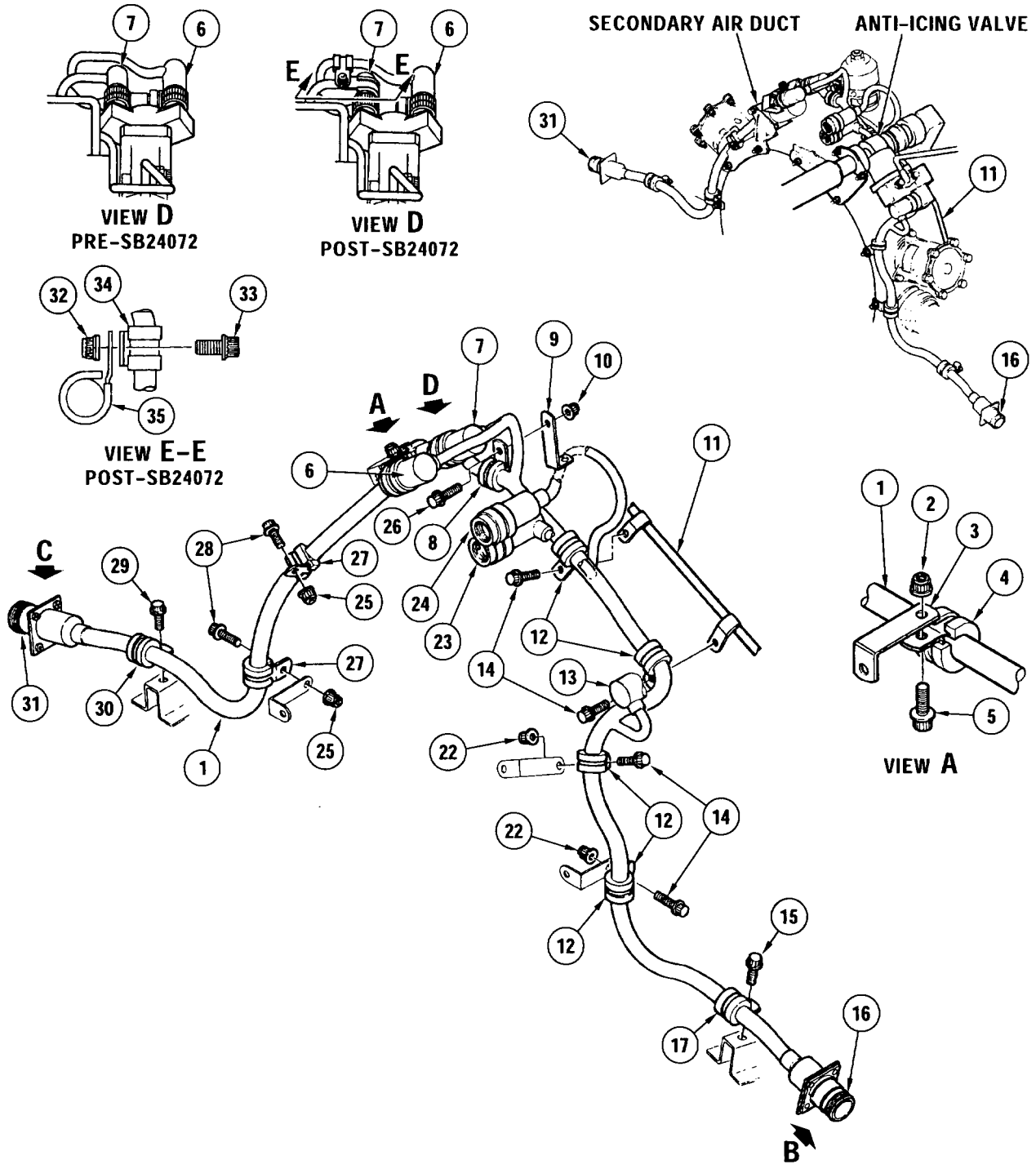
(10) Remove bolt (29) and loop clamp (30).

(11) Pre-SB24298: Remove four cap screws (18), four washers (19) and nut plate (21) (Ref. View C). Remove J30 connector (31) from right outer bypass duct. Remove and discard gasket (20).

(12) Post-SB24298: Remove two bolts (38), two washers (37) and bracket (36) (Ref. View C). Remove J30 connector (31) from right outer bypass duct. Remove and discard gasket (20).

(13) Remove P connectors (6, 7, 24, 23 and 18) and remove wiring harness (1).

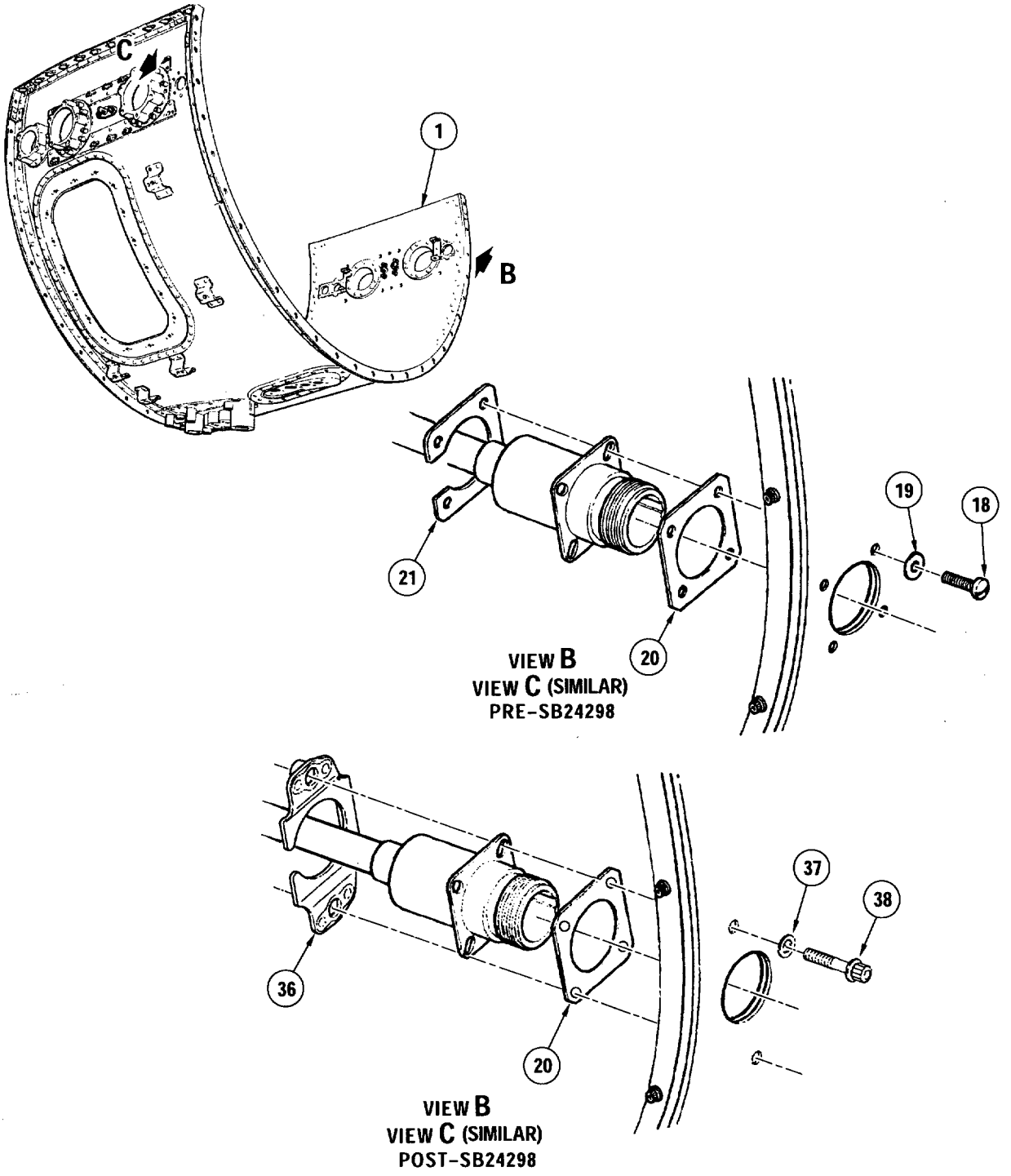
(14) Place protective covers on all connectors and receptacles.



Front Core Wiring Harness - Removal/Installation
Figure 203 (Sheet 1 of 2)

Key to Figure 203

1. Wiring Harness (Front Core)
2. Self-locking Nut
3. Bracket
4. Loop Clamp
5. Bolt
6. P13 Connector (Bleed Valve "A")
7. P14 Connector (Bleed Valve "B")
8. Loop Clamp
9. Bracket
10. Self-locking Nut
11. P3 Tube Assembly (Ref.)
12. Loop Clamp
13. P18 Connector (Anti-Icing Valve)
14. Bolt
15. Bolt
16. J29 Connector (Front Core Connection "A")
17. Loop Clamp
18. Screw
19. Washer
20. Gasket
21. Nut Plate (Pre-SB24298)
22. Self-locking Nut
23. P24 Connector (RVDT "B")
24. P25 Connector (RVDT "A")
25. Self-locking Nut
26. Bolt
27. Loop Clamp
28. Bolt
29. Bolt
30. Loop Clamp
31. J30 Connector (Front Core Connection "B")
32. Nut (Post-SB24072)
33. Bolt (Post-SB24072)
34. Clamp (Post-SB24072)
35. Clamp (Post-SB24072)
36. Bracket (Post-SB24298)
37. Washer (Post-SB24298)
38. Bolt (Post-SB24298)



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Front Core Wiring Harness - Removal/Installation
Figure 203 (Sheet 2)

D. Installation of Front Core Wiring Harness (Ref. Fig. 203)

CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN INSTALLING CONNECTORS.

CAUTION: DO NOT FORCE OR STRETCH HARNESS WHEN INSTALLING CONNECTORS OR FASTENING LOOP CLAMPS.

CAUTION: HARNESS CONNECTORS MUST BE ASSEMBLED WITH CLEAN, DRY THREADS. THE USE OF ENGINE OIL, SPRAY RELEASE AGENTS AND OTHER LUBRICANTS IS PROHIBITED.

CAUTION: INSTALL AND TORQUE CONNECTORS WITH APPROVED TOOLS ONLY. CONNECTORS ARE FULLY ENGAGED WHEN ONLY THE BLUE COLOR BAND IS VISIBLE. FINAL TORQUE OF THE CONNECTOR IS TO BE APPLIED USING SOFT-JAWED PLIERS.

(1) Apply electrical contact enhancer to all connectors (Ref. Ch. 70-00-00, CLEANING).

(2) Position front core wiring harness (1) on compressor rear case.

(3) Engage master keyway and install P24 connector (23) and P25 connector (24) on rotary stator vane actuator. Firmly grip the connector coupling nut with soft-jawed pliers (PWC90012) and apply hand pressure to tighten the nut until the pliers slip.

NOTE: Measurement of the actual torque is not required.

(4) Engage master keyway and install P18 connector (13) on anti-icing valve. Firmly grip the connector coupling nut with soft-jawed pliers (PWC90012) and apply hand pressure to tighten the nut until the pliers slip.

NOTE: Measurement of the actual torque is not required.

(5) Engage master keyway and install P14 connector (7) and P13 connector (6) on compressor bleed valve solenoid. Firmly grip the connector coupling nut with soft-jawed pliers (PWC90012) and apply hand pressure to tighten the nut until the pliers slip.

NOTE: Measurement of the actual torque is not required.

(6) Post-SB24072: Install clamp (35) on connector (7) and clamp (34) on cable with bolt (33) and nut (32).

(7) Pre-SB24298:

(a) Install gasket (20) on J29 connector (16).

(b) Position J29 connector (16) in left side of the lower bypass duct half with master keyway at the 12 o'clock position.

(c) Secure connector (16) using nut plate (21), four washers (19) and four cap screws (18). Torque 6 to 7 lb.in. (0.6-0.8 Nm).

(8) Post-SB24298:

(a) Install gasket (20) on J29 connector (16).

(b) Position J29 connector (16) in the left side of the lower bypass duct half with master keyway at the 12 o'clock position.

(c) Secure connector (16) using bracket (36), two washers (37), and two bolts (38). Torque to 36 to 40 lb.in. (4.0-4.6 Nm).

NOTE: The opening in bracket (36) faces to the rear of the engine.

(9) Position loop clamp (17) on wiring harness (1) and secure clamp to left side lower fairing using bolt (15). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(10) Position two loop clamps (12) on wiring harness (1). Secure clamps to P3 tube assembly (11) using two bolts (14). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(11) Position two loop clamps (12) on wiring harness (1). Secure clamps to flange mounted brackets using two bolts (14) and two self-locking nuts (22). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(12) Position loop clamp (8) on wiring harness (1). Secure clamp (8) to bracket (9) using bolt (26) and self-locking nut (10). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(13) Pre-SB24298:

(a) Install gasket (20) on J30 connector (31).

(b) Position J30 connector (31) in the right side of the lower bypass duct half with master keyway at top center.

(c) Secure connector (31) using nut plate (21), four washers (19) and four cap screws (18). Torque 6 to 7 lb.in. (0.6-0.8Nm).

(14) Post-SB24298:

(a) Install gasket (20) on J30 connector (31).

(b) Position J30 connector (31) in the right side of the lower bypass duct half with master keyway at the 12 o'clock position.

(c) Secure connector (31) using bracket (36), two washers (37), and two bolts (38). Torque to 36 to 40 lb.in. (4.0-4.6 Nm).

NOTE: The opening in bracket (36) faces to the rear of the engine.

(15) Position loop clamp (30) on wiring harness (1). Secure clamp (30) to right lower side fairing using bolt (29). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(16) Position two loop clamps (27) on wiring harness (1). Secure clamps (27) to flange mounted brackets using two bolts (28) and two self-locking nuts (25). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(17) Position loop clamp (4) on wiring harness (1). Secure clamp to bracket (3) using bolt (5) and self-locking nut (2). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(18) Install upper (outer and inner) sections of the bypass ducts (Ref. Chap. 72-70-01, BYPASS DUCTS - MAINTENANCE PRACTICES).

(19) Restore electrical power to appropriate system and reset EEC circuit breaker.

(20) Select maintenance test discrete OFF after wiring harness installation (Ref. Aircraft Maintenance Manual).

(21) Refer to Chapter 71-00-00, POWER PLANT, ADJUSTMENT/TEST, for checks following installation of engine wiring harness.

(22) Pull EEC circuit breaker to OFF.

CHAPTER 74

IGNITION

TABLE OF CONTENTS

SUBJECT	PAGE
IGNITION SYSTEM - DESCRIPTION AND OPERATION	**74-00-00**
1. General	1
2. Ignition Exciter	1
3. Ignition Cables	1
4. Spark Igniters	1

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Nov 19/99
	2 blank	Nov 19/99
Contents	1	Nov 19/99
	2 blank	Nov 19/99
74-00-00 Description and Operation	1	Nov 19/99
	2	Nov 19/99

IGNITION SYSTEM - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 1)

The spark ignition system has been developed to provide the engine with an ignition system capable of quick light up over a wide temperature range. Two exciter units, two individual high tension cable assemblies and two spark igniters are utilized. The system is energized from the aircraft normal 28 volt DC supply and will operate in the 9 to 30 volt range.

2. Ignition Exciter (Ref. Fig. 1)

The dual ignition exciter units are mounted and secured to a bracket on the right-hand side of the bottom section of the outer bypass duct. Four flexible absorption mounts are interposed between the mounting bracket and the bypass duct, thus dampening the effect of engine-induced vibration. Each exciter unit is secured to the mounting bracket with four bolts. Eight plate nuts are riveted on the mounting bracket to receive the exciter unit mounting bolt. Electrical bonding is achieved by a copper strap between the two units and a cable between one of the units and the rudder bias system transfer tube.

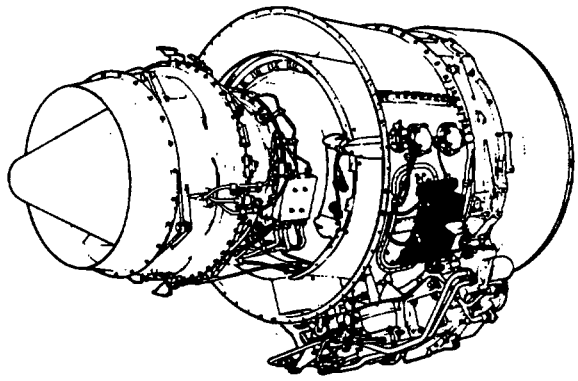
The ignition exciters are sealed units containing electronic components encased in an epoxy resin. The exciters transform the DC input to a pulsed high voltage output through solid state circuitry, a transformer and diodes.

3. Ignition Cables (Ref. Fig. 1)

The two individual ignition cable assemblies carry the electrical energy output from the ignition exciters to the engine-mounted spark igniters. Each lead assembly consists of an electrical lead encased in a flexible metal braiding. Coupling nuts at each end of the assembly facilitate connection to respective connectors on ignition exciter and spark igniter.

4. Spark Igniters (Ref. Fig. 1)

Two spark igniters, located at 4 and 5 o'clock positions respectively on the combustion chamber outer case, are screwed through bosses on the case to locate in the combustion chamber. The igniters are in the form of a threaded plug with a central positive electrode enclosed in an annular semi-conducting material. The electrical potential developed by the ignition exciter is applied across the gap between the central conductor and the igniter shell (ground). As this potential increases, a small current passes across the air gap. This current increases until the air between the central conductor and the shell ionizes. When ionization occurs, high energy discharges across the surface of the semi-conductor. The spark always occurs somewhere in the annular space between the central conductor and shell.



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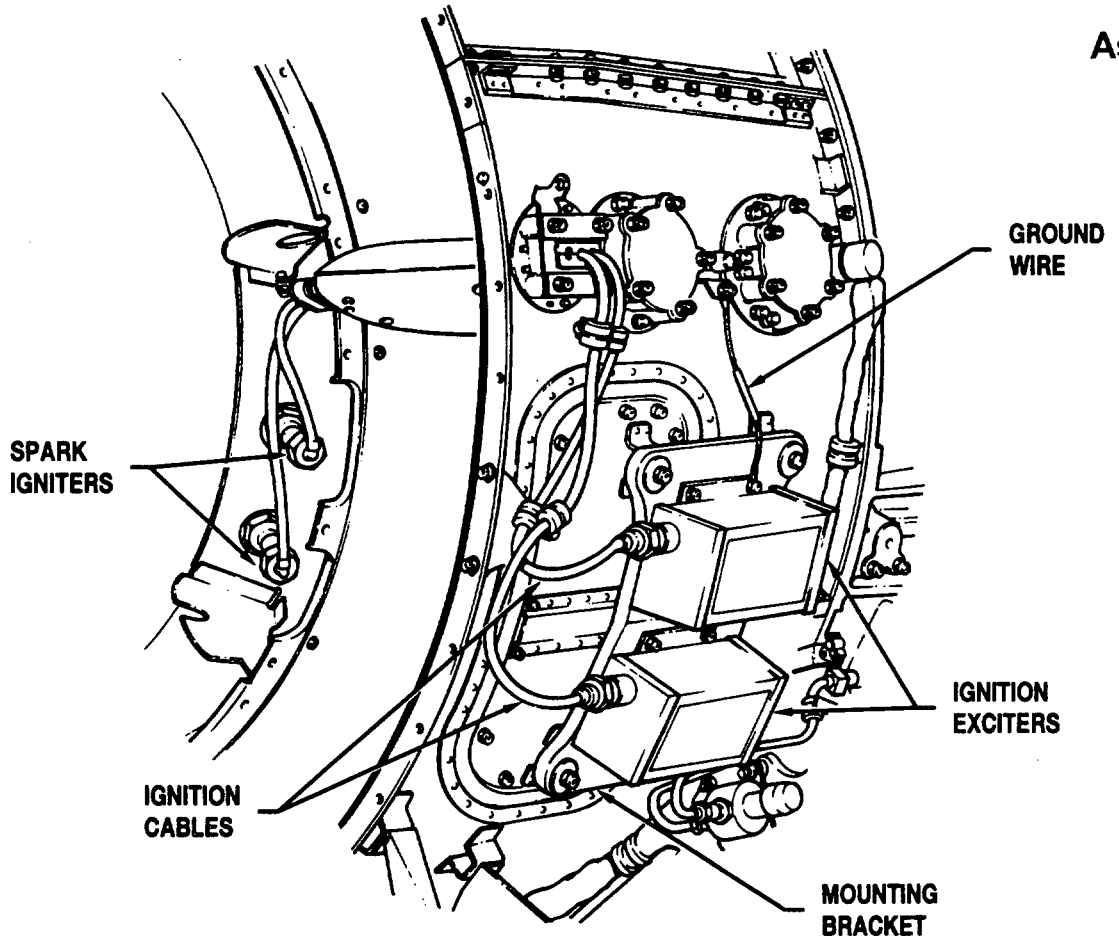

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Ignition System Components
Figure 1

TABLE OF CONTENTS

SUBJECT	PAGE
IGNITION SYSTEM - MAINTENANCE PRACTICES	**74-10-01**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Removal/Installation	201
A. Removal of Ignition Exciters	201
B. Installation of Ignition Exciters	203
C. Removal of Ignition Cables	204
D. Installation of Ignition Cables	204
E. Removal of Spark Igniters	205
F. Installation of Spark Igniters	205
6. Inspection/Check	207
A. Inspection of Ignition Exciter	207
B. Inspection of Ignition Cables	209
C. Inspection of Spark Igniters	209
7. Cleaning/Painting	212
A. Cleaning of Ignition Exciter	212
B. Cleaning of Spark Igniters	212
8. Adjustment/Test	213
A. Function Test	213

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Feb 15/2008
	2 blank	Feb 15/2008
Contents	1	Feb 15/2008
	2 blank	Feb 15/2008
74-10-01	201	Feb 15/2008
Maintenance	202	Feb 15/2008
Practices	203	Feb 15/2008
	204	Feb 15/2008
	205	Feb 15/2008
	206	Feb 15/2008
	207	Feb 15/2008
	208	Feb 15/2008
	209	Feb 15/2008
	210	Feb 15/2008
	211	Feb 15/2008
	212	Feb 15/2008
	213	Feb 15/2008
	214 blank	Feb 15/2008

IGNITION SYSTEM - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs in disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC05-089	Lockwire
PWC06-005	Lubricant, Fluorocarbon
PWC09-001	Sealant, Silicone Rubber
PWC11-002	Solvent, Cleaning

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Removal/Installation

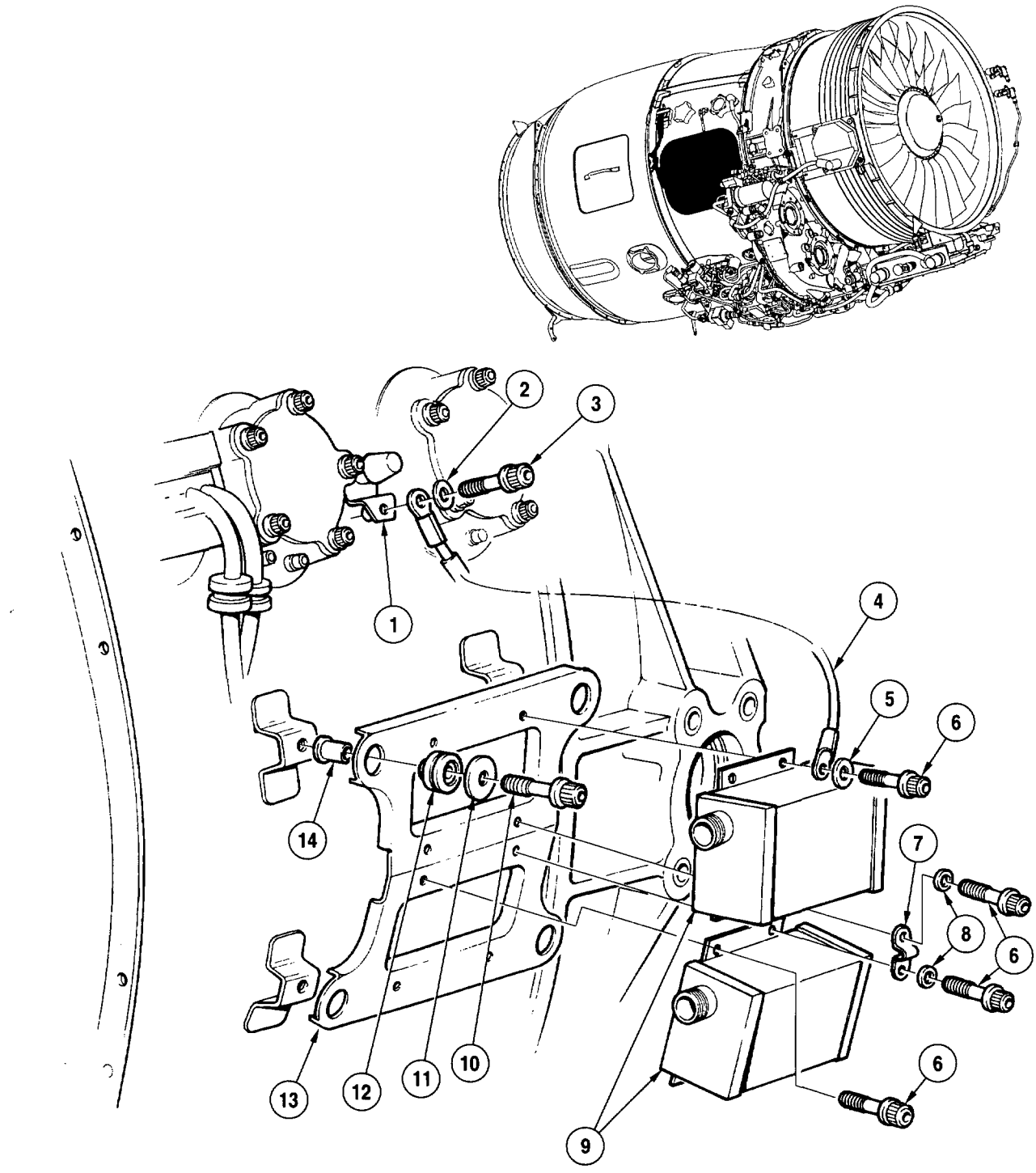
   WARNING: VOLTAGE OUTPUT OF IGNITION EXCITER IS SUFFICIENT TO CAUSE A LETHAL ELECTRICAL SHOCK. RESIDUAL VOLTAGE IN IGNITION EXCITER MAY BE DANGEROUSLY HIGH. MAKE SURE IGNITION IS SWITCHED OFF. DISCONNECT INPUT CONNECTOR FIRST (REF. AIRFRAME MAINTENANCE MANUAL) AND ALLOW AT LEAST SIX MINUTES TO ELAPSE BEFORE FURTHER WORK IS ATTEMPTED. DISCONNECT IGNITER CABLES AT EXCITER BEFORE DISCONNECTING AT IGNITER PLUGS. ALWAYS USE INSULATED TOOLS TO REMOVE CABLE COUPLING NUTS. DO NOT TOUCH OUTPUT CONNECTORS OR COUPLING NUTS WITH BARE HANDS.

   CAUTION: DO NOT LET IGNITION CABLE BRAIDING OR FERRULES ROTATE WHEN TURNING COUPLING NUTS.

   A. Removal of Ignition Exciters (Ref. Fig. 201)

      (1) Isolate power from ignition system.

      (2) Remove igniter cable assemblies from connectors of ignition exciters.



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Ignition Exciters - Removal/Installation
Figure 201

Key to Figure 201

1. Bracket
2. Washer
3. Bolt
4. Lead
5. Washer
6. Bolt
7. Connecting Strap
8. Washer
9. Ignition Exciter
10. Bolt
11. Washer
12. Mount
13. Mounting Plate
14. Sleeve

(3) Remove sealant from bolts (6) at electrical lead (4) and connecting strap (7) and remove eight bolts (6), three washers (5 and 8), connecting strap (7), electrical lead (4) and two ignition exciters (9) from mounting plate (13).

(4) Remove mounting plate (13) if necessary, by removing bolts (10) and washers (11).

B. Installation of Ignition Exciters (Ref. Fig. 201)

(1) Position mounting plate (13) on bypass duct and secure with four bolts (10) and washers (11). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(2) Position ignition exciters (9) with input connectors towards rear of engine on mounting plate and secure with bolts (6). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(3) Clean contact area of connecting strap (7) with solvent (PWC11-002) and install with bolts (6) and washers (8). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(4) Clean contact area on ends of lead (4), bracket (1) and ignition exciter (9) with solvent (PWC11-002). Install lead with bolts (3 and 6) and washers (2 and 5). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(5) Apply a coat of sealant (PWC09-001) to electrical contact areas on connecting strap (7) and lead (4).

(6) Connect ignition cable assemblies to connectors on ignition exciters (Ref. Subpara D.).

(7) Reconnect input cable to ignition exciter (Ref. Aircraft Maintenance Manual).

C. Removal of Ignition Cables (Ref. Fig. 202)

(1) Loosen coupling nuts (24) and disconnect ignition cables (23) from ignition exciters (11).

(2) Remove nut (10), spacer (9) and bolt (8). Remove two loop clamps (7).

(3) If necessary, remove two nuts (20), washers (22), bolt (21) and bracket (19).

(4) Remove nut (6), bolt (5) and two clamps (4).

(5) Remove four bolts (3), two brackets (2) and two grommets (1).

(6) Remove screws (17) and fairing (18) to gain access to grommet (13) and remove grommet from stiffener ring of inner bypass duct.

(7) Remove bolt (16), clamp (15) and cushion (14).

(8) Loosen coupling nuts (12) and disconnect ignition cables from spark igniters.

(9) For Pre-SB24340 ignition cable: Remove and discard key washers (25).

D. Installation of Ignition Cables (Ref. Fig. 202)

(1) Install spark igniters (Ref. Subpara. F.).

CAUTION: UNDER NO CIRCUMSTANCES IS LUBRICANT GREASE OR SILICONE, OR LUBRICANTS SUCH AS PETROLATUM TO BE USED ON ANY IGNITION COMPONENT.

CAUTION: DO NOT ALLOW ANY LUBRICANT TO COME IN CONTACT WITH CENTRAL CONDUCTORS OF CABLES. SUCH CONTACT MAY RESULT IN A HIGH RESISTANCE PATH, POSSIBLY GENERATING HEAT AND OXIDATION.

(2) For Pre-SB24340 ignition cable: Install new key washers (25) to igniter cable coupling nuts.

(3) Connect the coupling nuts (12) spark igniters (25). Torque 240 to 260 lb.in. (27.1-29.4 Nm).

CAUTION: UNDER NO CIRCUMSTANCES IS LUBRICANT GREASE OR SILICONE, OR LUBRICANTS SUCH AS PETROLATUM TO BE USED ON ANY IGNITION COMPONENT.

CAUTION: DO NOT ALLOW ANY LUBRICANT TO COME IN CONTACT WITH CENTRAL CONDUCTORS OF CABLES. SUCH CONTACT MAY RESULT IN A HIGH RESISTANCE PATH, POSSIBLY GENERATING HEAT AND OXIDATION.

(4) For Post-SB24340 ignition cable: Connect the coupling nuts (12) to spark igniters (25). Torque 240 to 260 lb.in. (27.1-29.4 Nm).

(5) Install grommet (13) around cables and slide into stiffener of inner bypass duct.

(6) Position cushion (14) and clamp (15) on igniter cables and fasten to fairing with bolt (16). Torque 36 to 40 lb.in. (4.1-4.5 Nm).

(7) Install fairing (18) with screws (17) and torque 36 to 40 lb.in. (4.1-4.5 Nm).

(8) Place two grommet halves (1) around cables and press into boss on outer bypass duct. Secure with two brackets (2) and four bolts (3). Torque 36 to 40 lb.in. (4.1-4.5 Nm) in a star pattern.

(9) Install two loop clamps (4) with bolt (5) and nut (6). Torque 27 to 30 lb.in. (3.1-3.4 Nm).

CAUTION: UNDER NO CIRCUMSTANCES IS LUBRICANT GREASE OR SILICONE, OR LUBRICANTS SUCH AS PETROLATUM TO BE USED ON ANY IGNITION COMPONENT.

CAUTION: DO NOT ALLOW ANY LUBRICANT TO COME IN CONTACT WITH CENTRAL CONDUCTORS OF CABLES. SUCH CONTACT MAY RESULT IN A HIGH RESISTANCE PATH, POSSIBLY GENERATING HEAT AND OXIDATION.

(10) Connect cable coupling nuts (24) to ignition exciters (11). Torque 140 to 160 lb.in. (15.8-18.1 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(11) Locate bracket (19) on rear flange of lower outer bypass duct, on fifth and sixth holes with two bolts (21), washers (22) and nuts (20). Torque 27 to 30 lb.in. (3.1-3.4 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(12) Install two loop clamps (7), spacer (9), bolt (8) and nut (10). Torque 27 to 30 lb.in. (3.1-3.4 Nm).

E. Removal of Spark Igniters (Ref. Fig. 203)

(1) Isolate power from ignition system.

(2) Carefully remove coupling nuts (3) of igniter cable assemblies from spark igniters (2).

(3) For Pre-SB24340 ignition cable: Remove and discard keywashers (5).

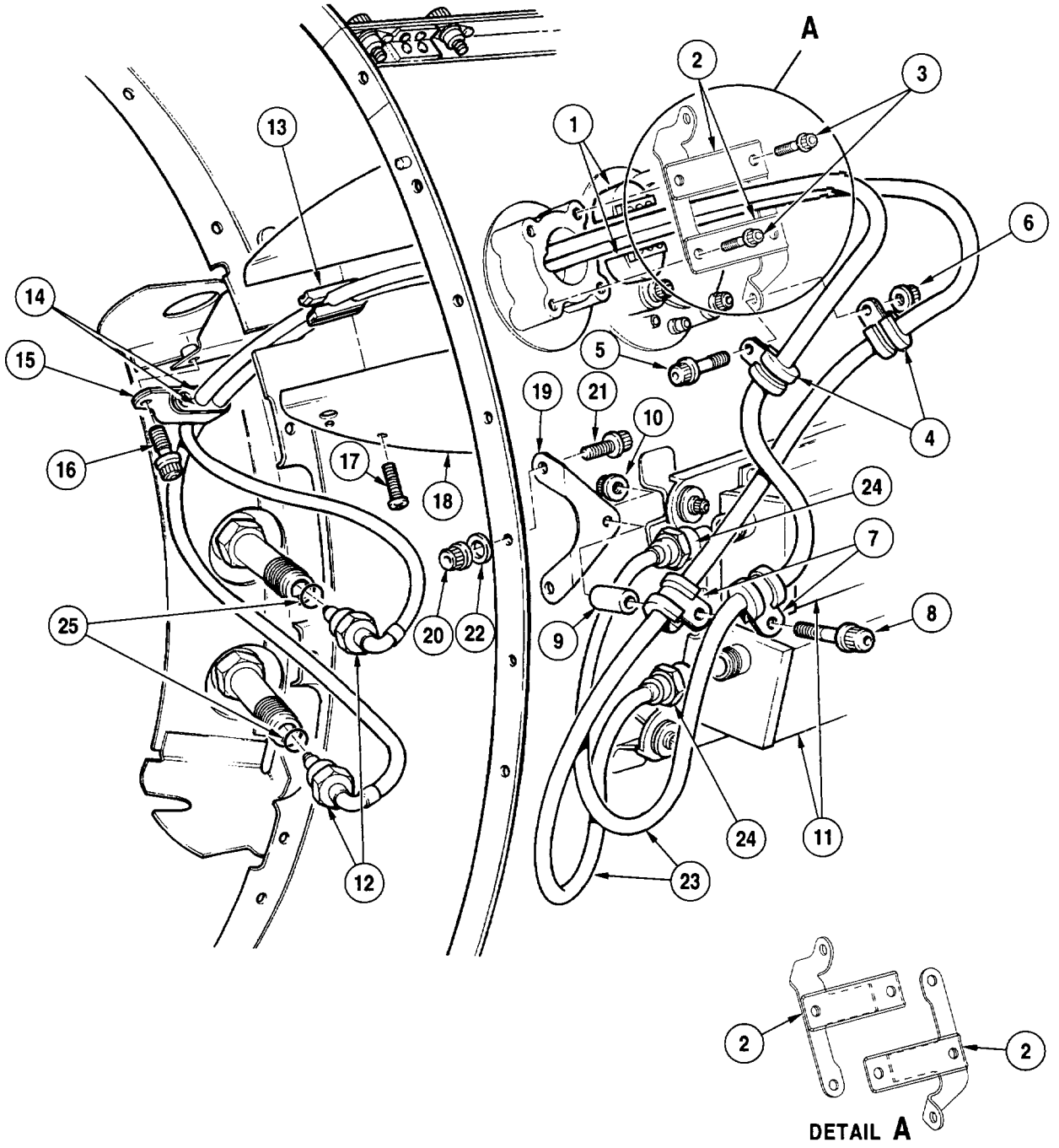
(4) Ground cable electrodes to spark shield to ensure complete electrical discharge.

(5) Unscrew and remove spark igniters (2) and gaskets (1).

(6) Remove gasket from each spark igniter.

F. Installation of Spark Igniters (Ref. Fig. 203)

(1) Install gasket (1) on each spark igniter (2).



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Ignition Cables - Removal/Installation
Figure 202

Key to Figure 202

1. Grommet
2. Bracket
3. Bolt
4. Loop Clamp
5. Bolt
6. Self-locking Nut
7. Loop Clamp
8. Bolt
9. Spacer
10. Self-locking Nut
11. Ignition Exciter
12. Coupling Nut
13. Grommet
14. Cushion
15. Clamp
16. Bolt
17. Screw
18. Fairing
19. Bracket
20. Self-locking Nut
21. Bolt
22. Washer
23. Ignition Cable
24. Coupling Nut
25. Key Washer (Post-SB24341)

CAUTION: MAKE SURE THE FLOATING COLLAR AROUND THE IGNITER BOSS ON THE COMBUSTION CHAMBER LINER MOVES FREELY BEFORE INSTALLING SPARK IGNITERS. INSTALL IGNITERS BY HAND UNTIL SEATED TO ENSURE THAT NO BINDING OR FOULING OCCURS.

(2) Carefully install spark igniters with gaskets into bosses in combustion chamber outer case at 4 and 5 o'clock positions on engine without using tools, until igniters are seated.

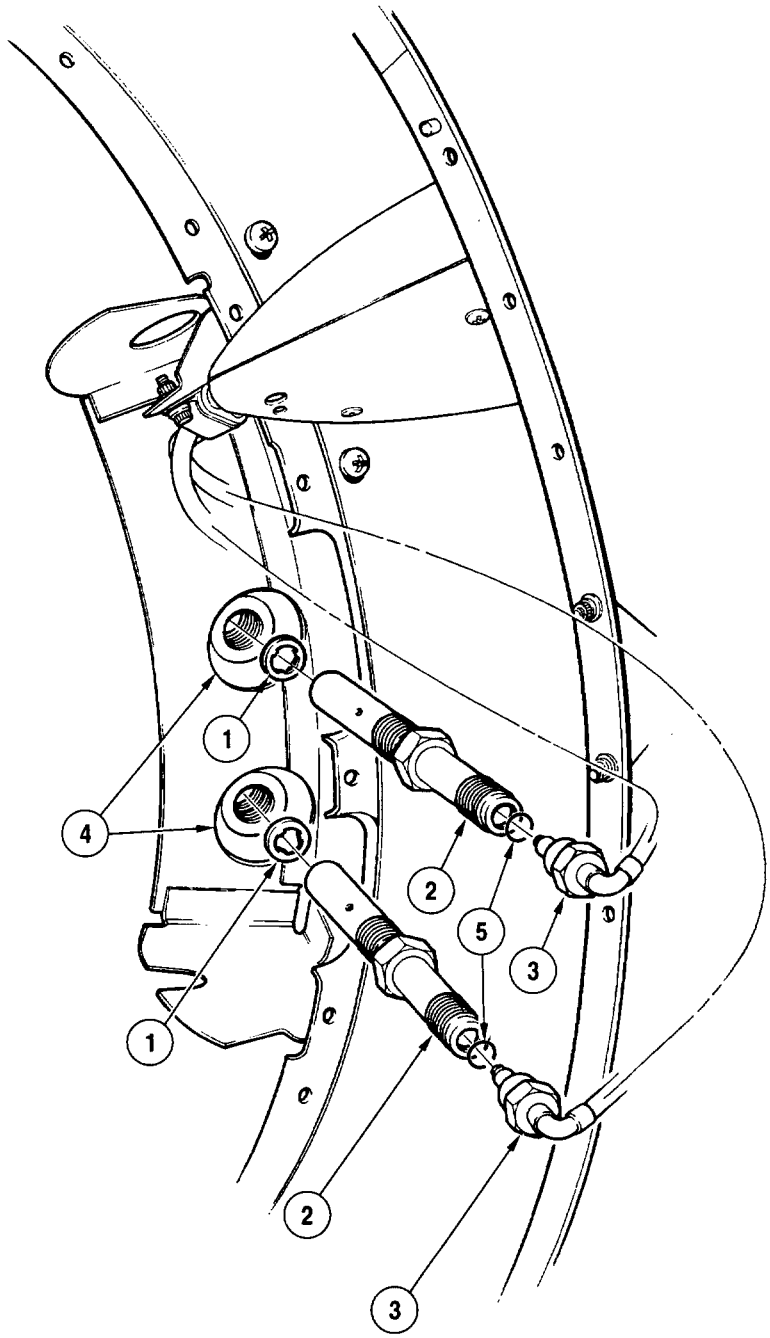
(3) Torque igniters 300 to 360 lb.in. (33.9-40.7 Nm).

6. Inspection/Check

A. Inspection of Ignition Exciter

(1) Inspect for security, signs of damage and general condition.

(2) Inspect input and output connectors for damage. Check threads for corrosion.



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Spark Igniters - Removal/Installation
Figure 203

Key to Figure 203

1. Gasket
2. Spark Igniter
3. Coupling Nut
4. Igniter Boss (Ref.)
5. Key Washer (Post-SB24341)

B. Inspection of Ignition Cables

(1) Check for chafing, cuts, abrasions or other damage.

(2) Check for security of installation.

(3) Check operation of cables (Ref. Para. 8.).

C. Inspection of Spark Igniters (Ref. Fig. 204)

(1) Inspect the external sheath of each igniter at Dia. A for chafing and wear:

(a) Pre-SB24317: Replace igniter if the following limits are exceeded:

1 0.020 in. at the deepest point.

2 120 degrees of circumference.

3 Wall thickness can not be worn through exposing internal air gap.

(b) Post-SB24317: Replace igniter if the following limits are exceeded:

1 0.010 in. at the deepest point.

2 360 degrees of circumference.

3 Wall thickness cannot be worn through exposing internal air gap.

(c) Post-SB24341: Replace igniter if the following limits are exceeded:

1 0.0115 in. at the deepest point all around 360 degrees.

2 0.025 in. at the deepest point over 0.350 in. circumferential length.

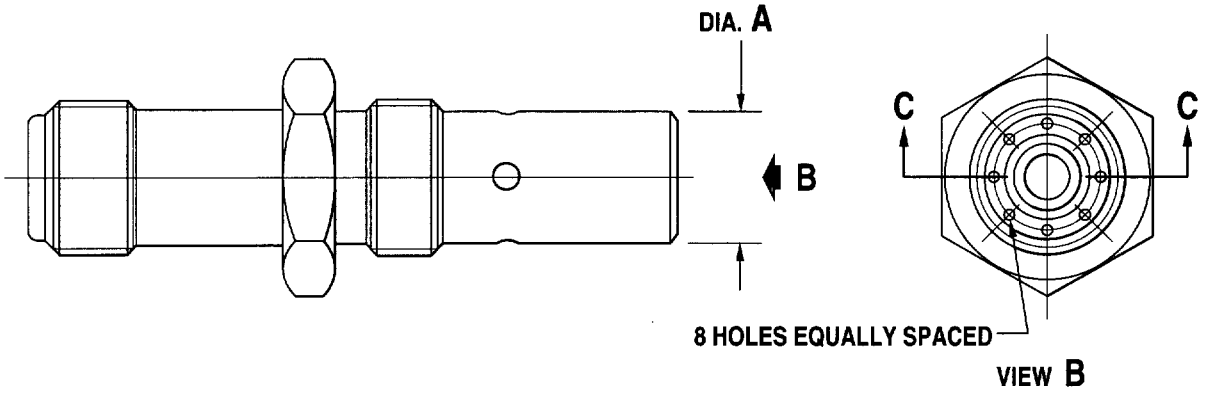
3 Wall thickness cannot be worn through exposing internal gap.

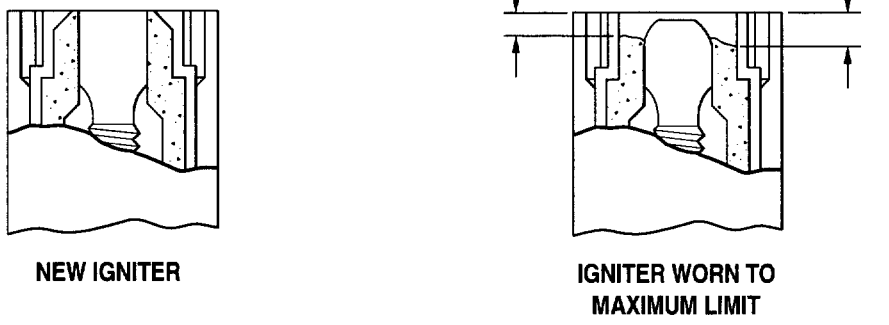
(2) Inspect end face (View B) for:

(a) Blockage of air hole. If any air hole is blocked, reject igniter.

(b) Reduction in any air hole area. Reject igniter if evident.

(c) Erosion of electrode:





SECTION C – C

PRE-SB24341

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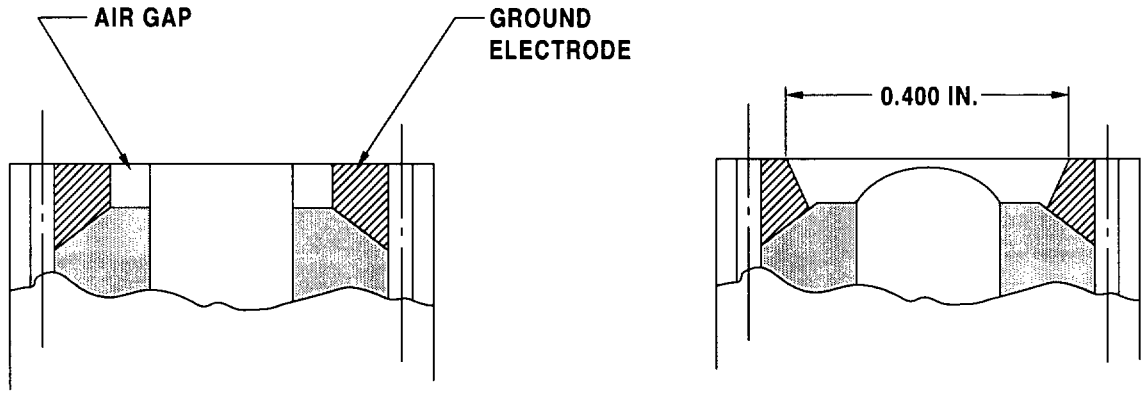
Spark Igniter - Inspection
Figure 204 (Sheet 1 of 2)



POST-SB24341

C24653A

Spark Igniter - Inspection
Figure 204 (Sheet 2)

1 Pre-SB24341: Erosion up to 0.118 inch deep is acceptable. Localized erosion of insulation up to 0.125 inch deep is acceptable provided 75 percent of the original surface remains within the 0.118 inch erosion band. If erosion exceeds any of these limits, reject igniter.

2 Post-SB24341: Erosion up to 0.400 inch diameter is acceptable. Measure at the tip of the inner diameter.

(3) Check operation of spark igniters (Ref. Para. 8.).

7. Cleaning/Painting

A. Cleaning of Ignition Exciter

(1) Remove all corrosion residue, using a stainless steel wire brush, taking care not to damage gold plating on the terminal pins.

(2) Clean affected surface thoroughly, using a clean, lint-free cloth moistened with solvent (PWC11-022).

(3) Apply light film of spray lubricant (PWC06-005) to cleaned areas.

B. Cleaning of Spark Igniters

CAUTION: DROPPED IGNITERS MAY SUFFER INTERNAL DAMAGE NOT DETECTABLE BY TEST. DISCARD ANY IGNITER THAT HAS BEEN DROPPED.

CAUTION: DO NOT TRY TO REMOVE ANY HARD CARBON DEPOSITS FROM CENTER ELECTRODE AS SUCH DEPOSITS AID THE FUNCTIONING OF THE IGNITER. ANY ABRASIVE ACTION IN GAP AREA MAY IMPAIR FUNCTIONING BY THE REMOVAL OF SEMICONDUCTOR MATERIAL. DO NOT USE WIRE BRUSH TO CLEAN.

(1) Install a suitable cap over electrode end of igniter to prevent contamination by cleaning fluid.

(2) Clean inside of terminal well with a felt swab soaked in solvent (PWC11-022). Do not damage terminal pin during cleaning operation.

(3) Dry using clean, dry, filtered compressed air.

8. Adjustment/Test

WARNING: VOLTAGE OUTPUT OF IGNITION EXCITER IS SUFFICIENT TO CAUSE A LETHAL ELECTRICAL SHOCK. RESIDUAL VOLTAGE IN IGNITION EXCITER MAY BE DANGEROUSLY HIGH. ENSURE IGNITION IS SWITCHED OFF. DISCONNECT INPUT CONNECTOR FIRST (REF. AIRFRAME MAINTENANCE MANUAL) AND ALLOW AT LEAST SIX MINUTES TO ELAPSE BEFORE FURTHER WORK IS ATTEMPTED. DISCONNECT IGNITER CABLES AT EXCITER BEFORE DISCONNECTING AT IGNITER PLUGS. ALWAYS USE INSULATED TOOLS TO REMOVE CABLE COUPLING NUTS. DO NOT TOUCH OUTPUT CONNECTORS OR COUPLING NUTS WITH BARE HANDS.

CAUTION: DO NOT ALLOW IGNITION CABLE BRAIDING OR FERRULES TO ROTATE WHEN TURNING COUPLING NUTS.

A. Function Test

CAUTION: BEFORE SWITCHING ON IGNITION TO DO AN OPERATIONAL CHECK, DO A DRY MOTORING RUN 71-00-00, ADJUSTMENT/TEST TO MAKE SURE NO FUEL REMAINS IN GAS GENERATOR CASE.

(1) Switch ignition system OFF.

(2) Isolate electrical power from ignition system (Ref. Aircraft Maintenance Manual).

(3) Disconnect one igniter input lead at exciter unit.

(4) Restore electrical power to ignition system (Ref. Aircraft Maintenance Manual).

(5) Switch ignition ON.

(6) Listen for regular frequency snapping sound. Switch ignition OFF.

(7) Reconnect igniter cable to exciter unit and remove igniter cable from other exciter unit. Repeat steps (3) and (4).

(8) If snapping sound is not heard on either check, replace ignition exciter and repeat steps (1) through (5).

(9) If snapping sound is not heard on one check only, replace associated spark igniter and/or ignition cable and repeat operation check. If spark igniter still fails, replace ignition exciter.

(10) Repeat steps (1) through (9).

(11) Restore ignition system to standard operating condition.

(12) Refer to Chapter 71-00-00 for checks following installation of ignition system components.

CHAPTER

75

AIR

TABLE OF CONTENTS

SUBJECT	PAGE
AIR SYSTEMS - DESCRIPTION AND OPERATION	**75-00-00**
1. General	1
2. Bearing Compartment Seals - Pressurizing Air	1
3. High Pressure (HP) Turbine Disks and Stators - Cooling Air	2
4. Anti-icing - Hot Air	2
5. Compressor Bleed Valves	2
6. Stator Vane Actuator	3
A. Rotary Actuator Pre-SB24369	3
B. Linear Actuator Post-SB24369	3
7. Airframe Services	4

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Jan 17/2003
	2 blank	Jan 17/2003
Contents	1	Jan 17/2003
	2 blank	Jan 17/2003
75-00-00 Description and Operation	1	Jan 17/2003
	2	Jan 17/2003
	3	Jan 17/2003
	4	Jan 17/2003
	5	Jan 17/2003
	6	Jan 17/2003
	7	Jan 17/2003
	8	Jan 17/2003
	9	Jan 17/2003
	10	Jan 17/2003
	11	Jan 17/2003
	12 blank	Jan 17/2003

AIR SYSTEMS - DESCRIPTION AND OPERATION

1. General

High pressure (HP) compressor discharge air is bled off to provide pressurizing air for bearing compartment oil seals, cooling air for the turbine section, air for the compressor bleed valves and hot air for anti-icing protection of the low pressure (LP) compressor stator and nose cone. Additionally, bleed air is provided for the Electronic Engine Control and for aircraft services.

2. Bearing Compartment Seals - Pressurizing Air (Ref. Fig. 1)

Oil is contained within the bearing compartments by bleeding air pressure through carbon seals and/or labyrinth seals towards each bearing. The labyrinth seals used on the engine consist of two parts: a labyrinth and a runner. The rotating labyrinths have a series of annular grooves machined in their outer surfaces, while the corresponding runners have plain or honeycombed surfaces. Each matched pair forms an airseal and controls the required pressure gradient.

P2.8 pressurizing air, bled from the fourth-stage of the HP compressor, is split into two paths; one is ducted through the intermediate case and into the hollow LP and HP compressor shafts, where it is directed to the Nos. 1, 2 and 4 bearing compartments. The second path passes through the gas generator case via an internal passageway into the No. 3 bearing compartment.

The carbon seals at the rear of the No. 1 bearing and at the front of the No. 2 bearing are pressurized by the flow of air passing through the intermediate case into the intershaft space. Holes at the front of the LP shaft direct the air into the labyrinth seal at the front of the No. 1 bearing. Air is allowed to leak through the labyrinth to form a pressure seal, and is then vented to the inlet air stream behind the inlet cone.

Holes in the HP compressor shaft direct a portion of the intershaft flow of air to the rear labyrinth and carbon seal of the No. 2 bearing. Air leakage through the seals exits into the gas stream at the first-stage of the HP compressor rotor.

Air pressure inside the LP shaft flows forward into the nose cone and rearward into the front labyrinth seal of the No. 4 bearing compartment, venting into the exhaust gas stream behind the third-stage LP turbine. The No. 4 bearing compartment is sealed at the rear by the LP turbine case, hence no labyrinth seal is required at the rear.

P2.8 air entering the No. 3 bearing compartment is directed around the bearing into the front and rear bearing covers, pressurizing the front and rear labyrinth and carbon seals. Impeller backface air assists in the pressurization and is allowed to leak into the bearing compartment. Excess air flows through holes in the HP turbine shaft and the HP turbine assembly into the intershaft space.

The air entering the bearing compartments is also used to assist the oil scavenge flow to the accessory gearbox from where it is vented to atmosphere through the centrifugal breather.

3. High Pressure (HP) Turbine Disks and Stators - Cooling Air (Ref. Fig. 1)

Air from around the combustion chamber liner (P3) passes through the HP turbine disk air nozzle and the HP turbine baffle to cool the HP turbines and stators. Air from the nozzle is directed at the hub of the first-stage HP turbine disk and is directed across the disk face by a cover. The cover directs the air through the blade roots and into the hollow turbine blades, exiting into the gas path through holes in the trailing edges. Cooling air for the second-stage HP turbine disk flows from the impeller backface, through holes in the HP turbine disk assembly and is directed along the disk faces through holes in the interstage baffle and a stacked multi-stage seal. The air then passes through the second-stage blade roots and exits into the gas stream.

Cooling air passing around the outside diameter of the HP turbine assembly is directed by the HP turbine baffle to the shroud segments and stator assemblies. Hollow vanes on the first-stage HP turbine stator assembly allow internal flow of cooling air which exits the vanes through holes in the trailing edges.

P2.8 air leaving the intershaft space at the rear of the HP turbine assembly is directed across the LP turbine disk faces and through the blade roots and exits into the gas stream.

4. Anti-icing - Hot Air (Ref. Fig. 1)

The nose and LP compressor inner stator are heated by pressurized hot air (P2.8) routed from the fourth-stage compressor. A solenoid valve controls the flow to the inner stator while the nose cone is fed hot air continuously.

The nose cone is heated by hot air flowing from the inside of the LP shaft, through the hollow nose cone extension and into the double-walled nose cone. A small part of the air is discharged through the nose cone central tie bolt. The hot air inside the nose cone vents into the air stream ahead of the fan. The hot air which heats the nose cone follows a different path from the rest of the anti-icing air and hence is not controlled by the anti-icing solenoid valve.

A transfer tube from the solenoid valve directs the flow of hot air into a cavity in the intermediate case to heat the inner fan stators. Air exiting from the fan stators is vented into the core air-flow.

5. Compressor Bleed Valves (Ref. Figs. 2 and 3)

Three compressor bleed valves are located on the HP compressor rear case at the 3, 5 and 9 o'clock positions. Two bleed valves at 3 and 9 o'clock bleed P2.5 interstage air, while the bleed valve at 7 o'clock bleeds P2.8 air downstream of the fourth stage axial compressor.

The bleed valves consist of two-position (open/closed) piston type valves, operating in ported housings. The P2.8 bleed valve pistons are spring loaded open, allowing compressor air to vent into the bypass air-flow. When P3 compressor discharge pressure from the solenoid valve is applied, spring force is overcome and the pistons are closed. The pistons are supported in their housings by two sealing rings and a guide pin. The inner piston ring is metal, while the outer ring is made from heat-resistant plastic. The piston rings seal the chamber at the top of the piston, while the guide pin permits full travel of the piston in either direction, to open or close the housing ports.

The compressor bleed solenoid valve is located at the top of the HP compressor rear case, supported by a bracket on the rear flange. The valve is normally closed, blocking the flow of P3 air from the diffuser to the compressor bleed valves. The solenoid consists of a dual coil housing surrounding an armature assembly, attached to a shaft and ball-type piston. The piston is spring-loaded closed until the solenoid is energized by the EEC, causing the armature to overcome the spring force, opening the valve and directing P3 air to the bleed valves.

6. Stator Vane Actuator

A. Rotary Actuator Pre-SB24369 (Ref. Fig. 4)

The rotary stator vane actuator is a two vane hydraulic actuator, which uses fuel from the Hydro-mechanical Metering Unit (HMU) for hydraulic power. The actuator is controlled by a torquemotor valve contained in the HMU. An electrical signal from the EEC energized one of two windings (Channel A or B) on the torquemotor valve, which alters the two hydraulic (fuel pressure) signals going to the actuator. Fuel pressure from the actuator directs the fuel into cavities formed by the vane assembly in the cylinder assembly. The differential pressure between the cavities causes rotary movement of the vane assembly, thus driving the actuator output levers. A third transfer tube drains internal fuel leakage from the actuator to an airframe supplied drain.

Displacement of the vane assembly is sensed by one of two rotary variable differential transformer (RVDT)-type position transducers in the actuator, which convert the signal from mechanical to electrical, and feed the signal back to the EEC. When the electrical feedback signal from the actuator matches the EEC-calculated demand signal, hydraulic signals are equalized and actuator movement ceases.

B. Linear Actuator Post-SB24369 (Ref. Fig. 5)

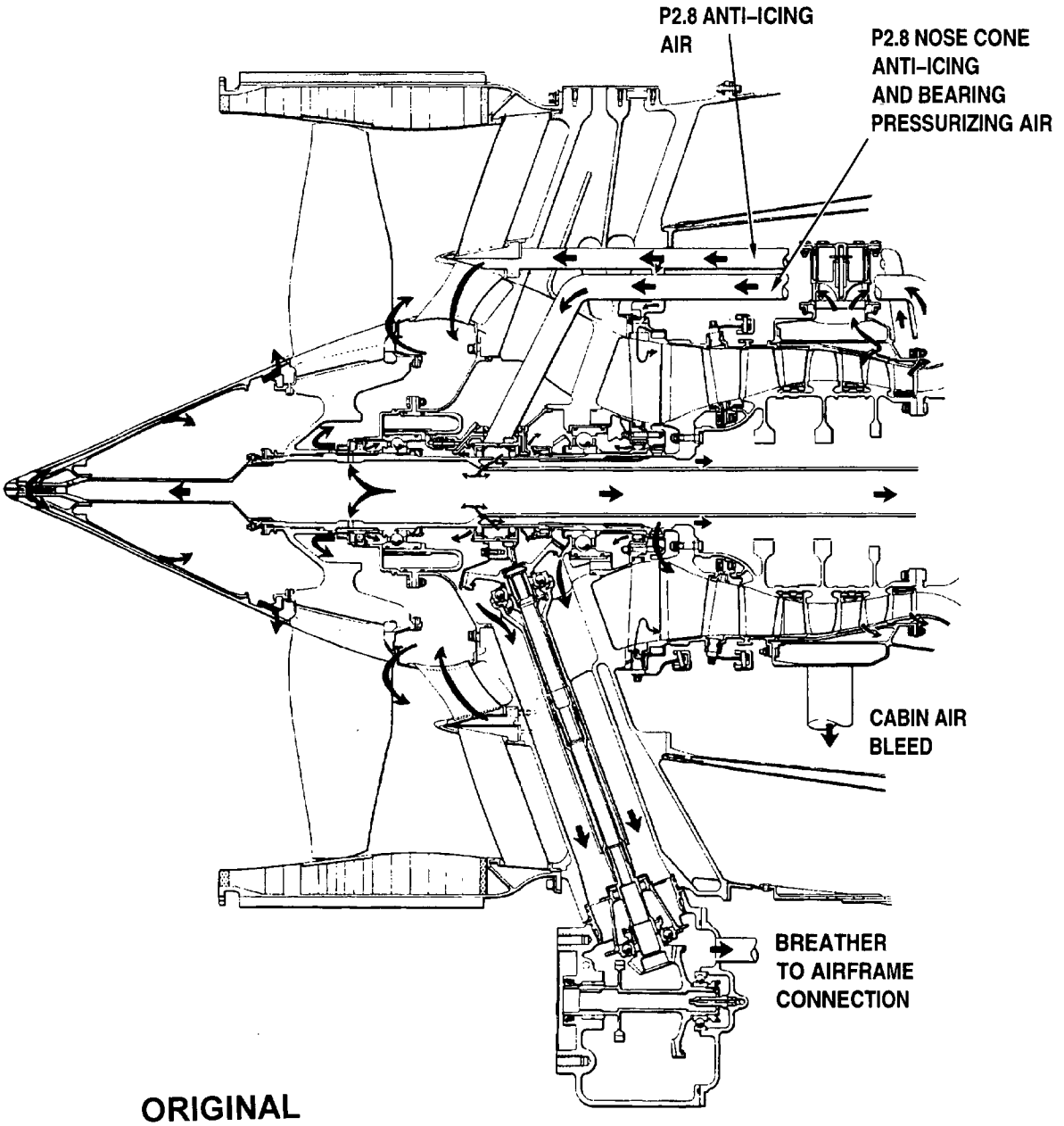
The linear actuator is located on the top of the HP compressor case. The actuator body is mounted to the rear flange of the front HP compressor case by a supporting bracket. The actuator piston rod is connected to the master lever of the HP CVV drive system. The master lever is free to pivot on Teflon lined bushings.

The linear actuator uses fuel from the HMU for hydraulic power. The actuator is controlled by a torquemotor valve contained in the HMU. An electrical signal from the EEC energizes one of two windings (Channel A or B) on the torquemotor valve, which alter the two hydraulic (fuel pressure) signals going to the actuator. Fuel pressure from the actuator directs the fuel into the cylinder assembly. The differential pressure in the cylinder causes linear movement of the piston, thus driving the actuator output levers. A third transfer tube drains internal fuel leakage from the actuator to an airframe supplied drain.

Displacement of the piston is sensed by a linear variable differential transformer (LVDT)-type position transducer in the actuator, which converts the signal from mechanical to electrical, and feeds the signal back to the EEC. When the electrical feedback signal from the actuator matches the EEC-calculated demand signal, hydraulic signals are equalized and actuator movement ceases.

7. Airframe Services

Pads, located at the 3 and 9 o'clock positions on the gas generator case and the HP compressor rear case, enable airframe supplied equipment to utilize engine P3 compressor discharge air pressure. The pads provide off-take of air from around the diffuser pipes.


P2.8 ANTI-ICING AIR
P2.8 NOSE CONE ANTI-ICING AND BEARING PRESSURIZING AIR
CABIN AIR BLEED
BREATHER TO AIRFRAME CONNECTION

ORIGINAL
As Received By
ATP

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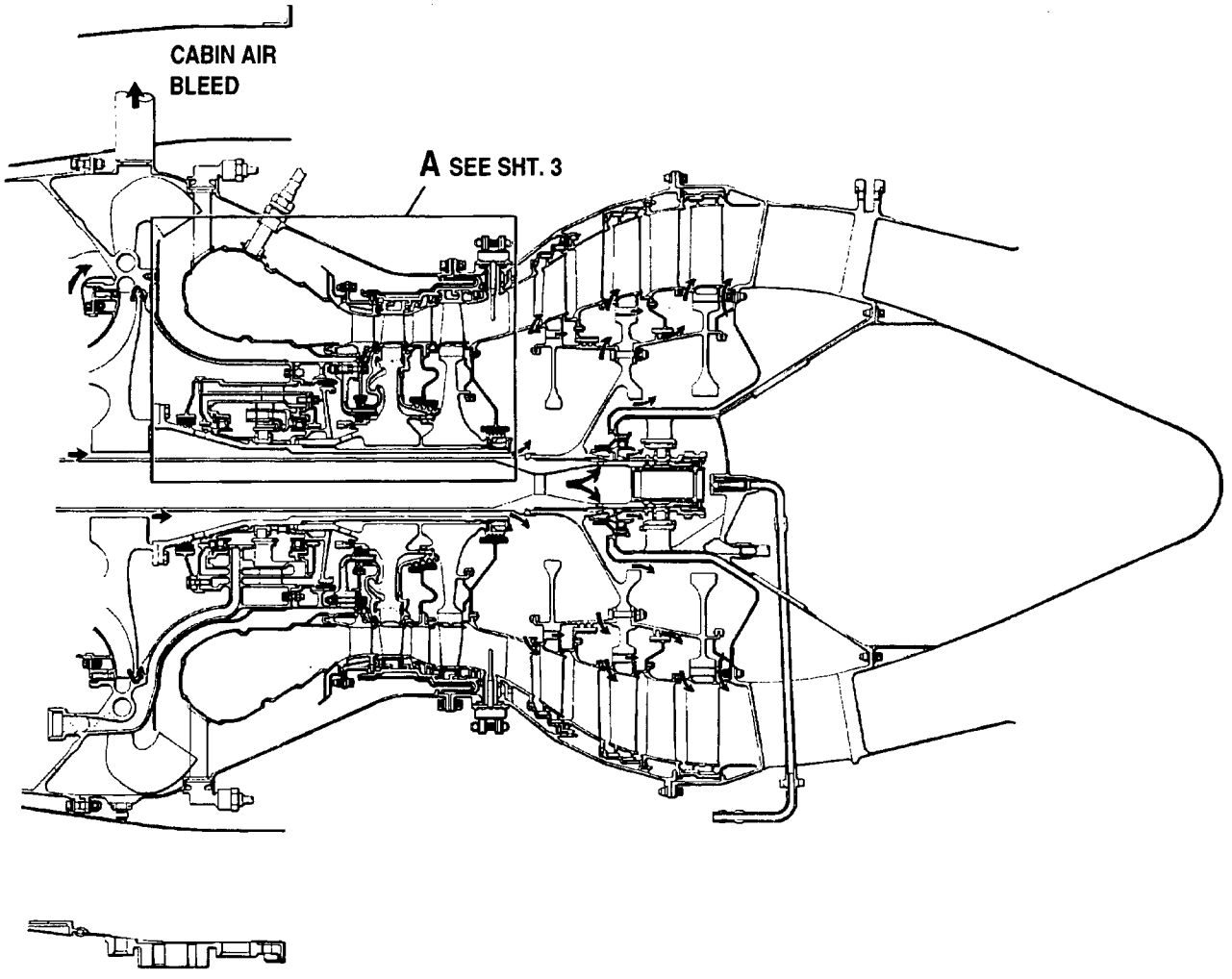
Air System
Figure 1 (Sheet 1 of 3)



ORIGINAL
As Received By
ATP

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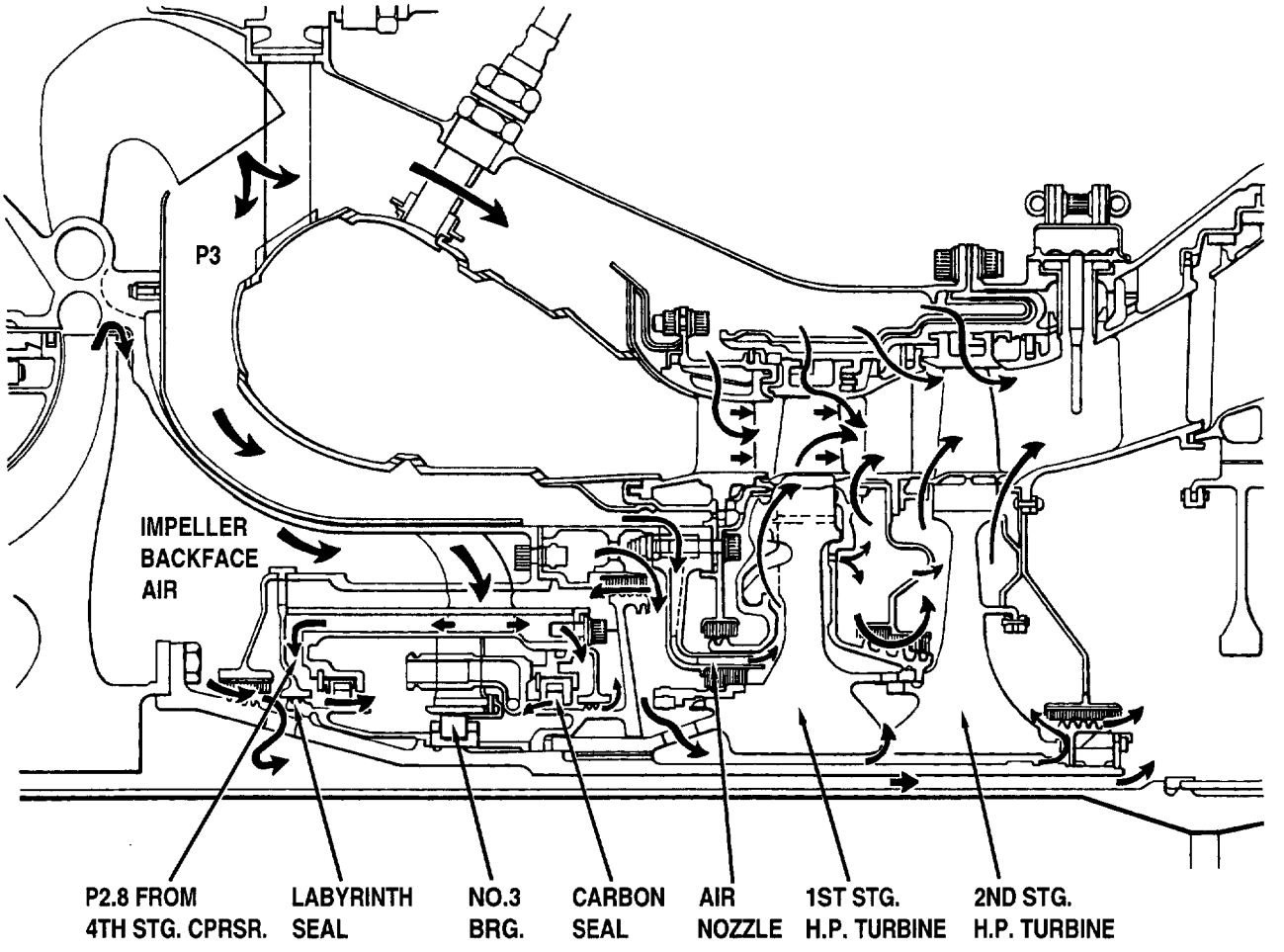
Air System
Figure 1 (Sheet 2)



VIEW **A**

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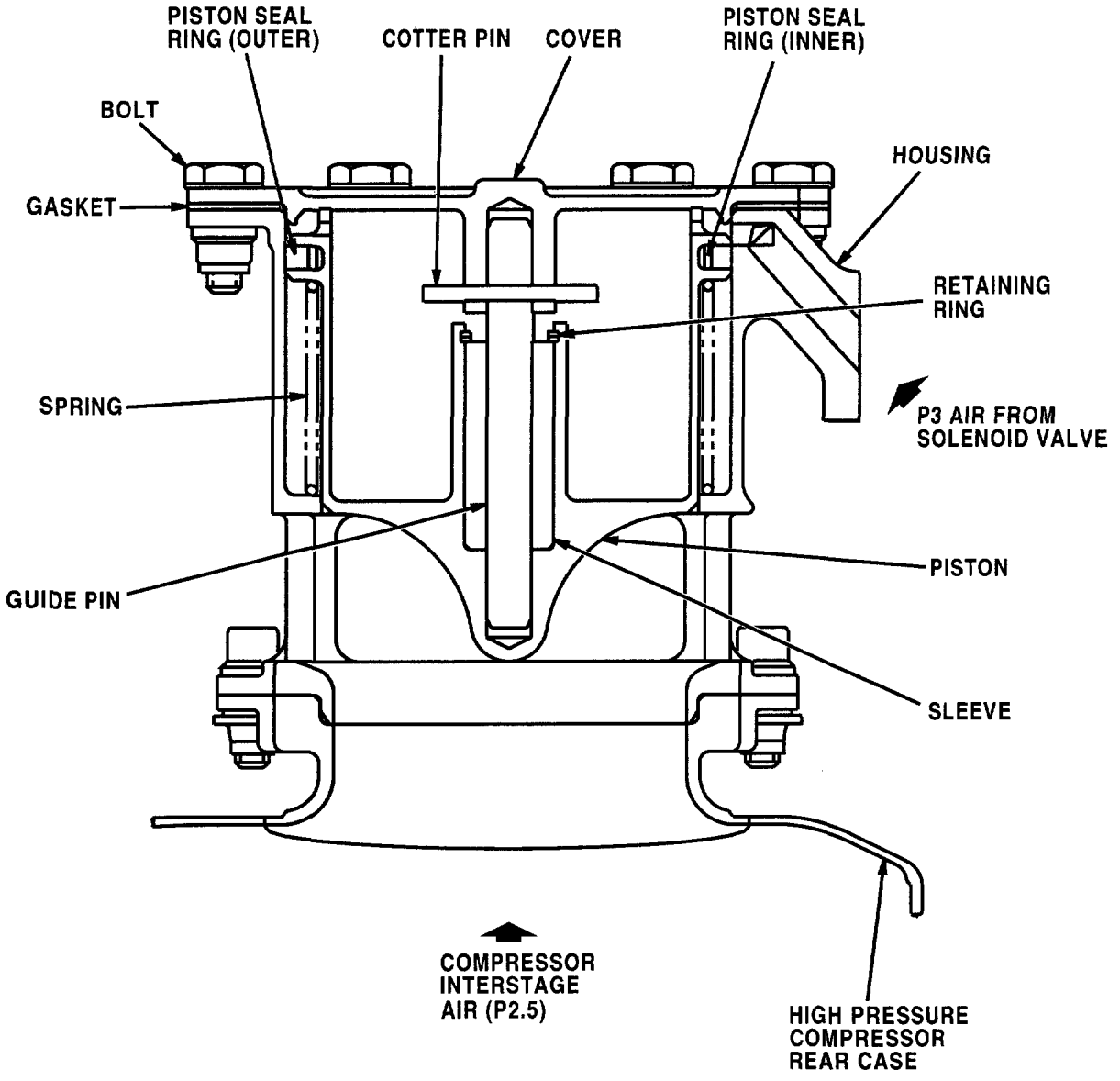
Air System
Figure 1 (Sheet 3)



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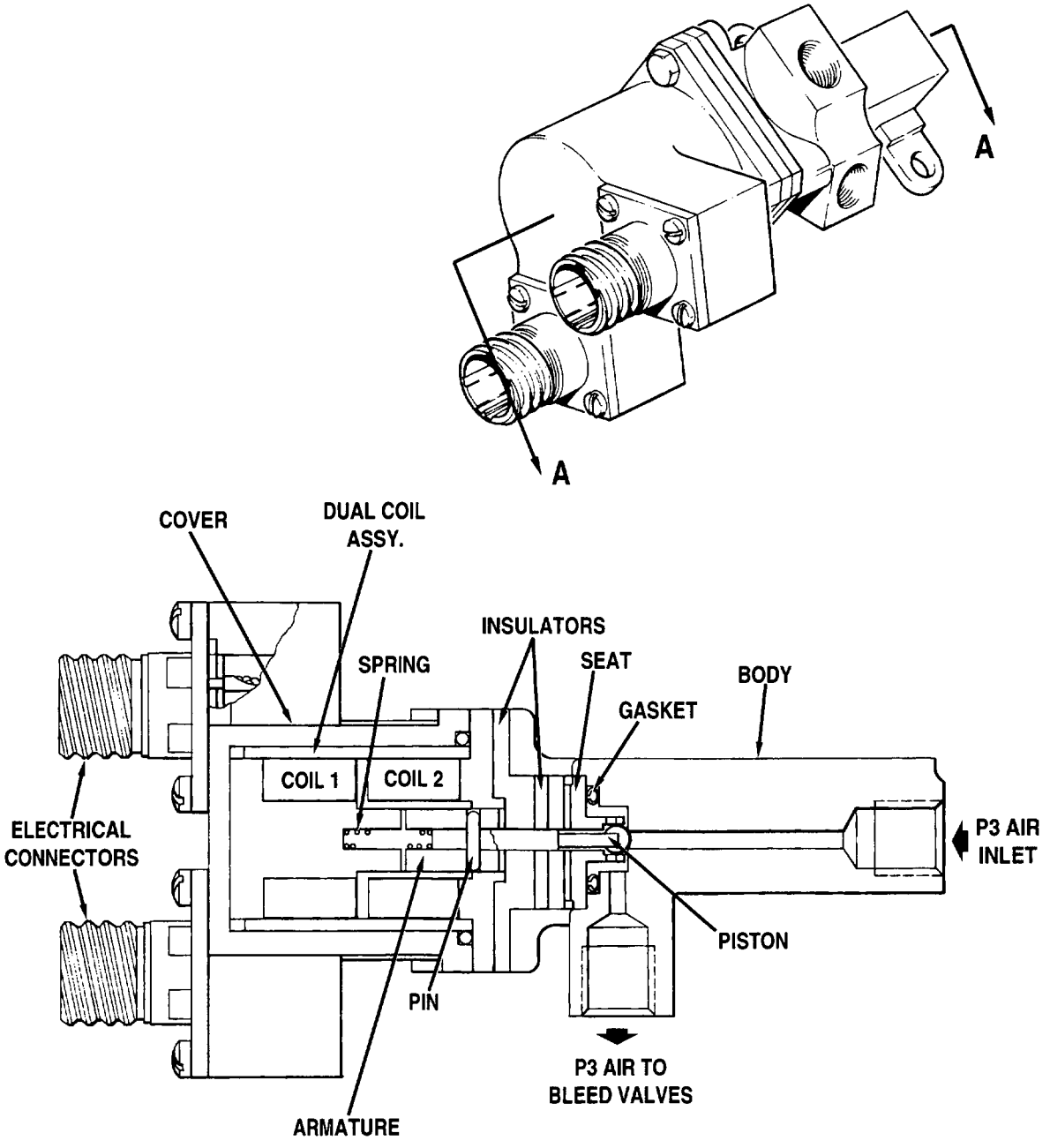
Compressor Bleed Valve Cross Section (Typical)
Figure 2



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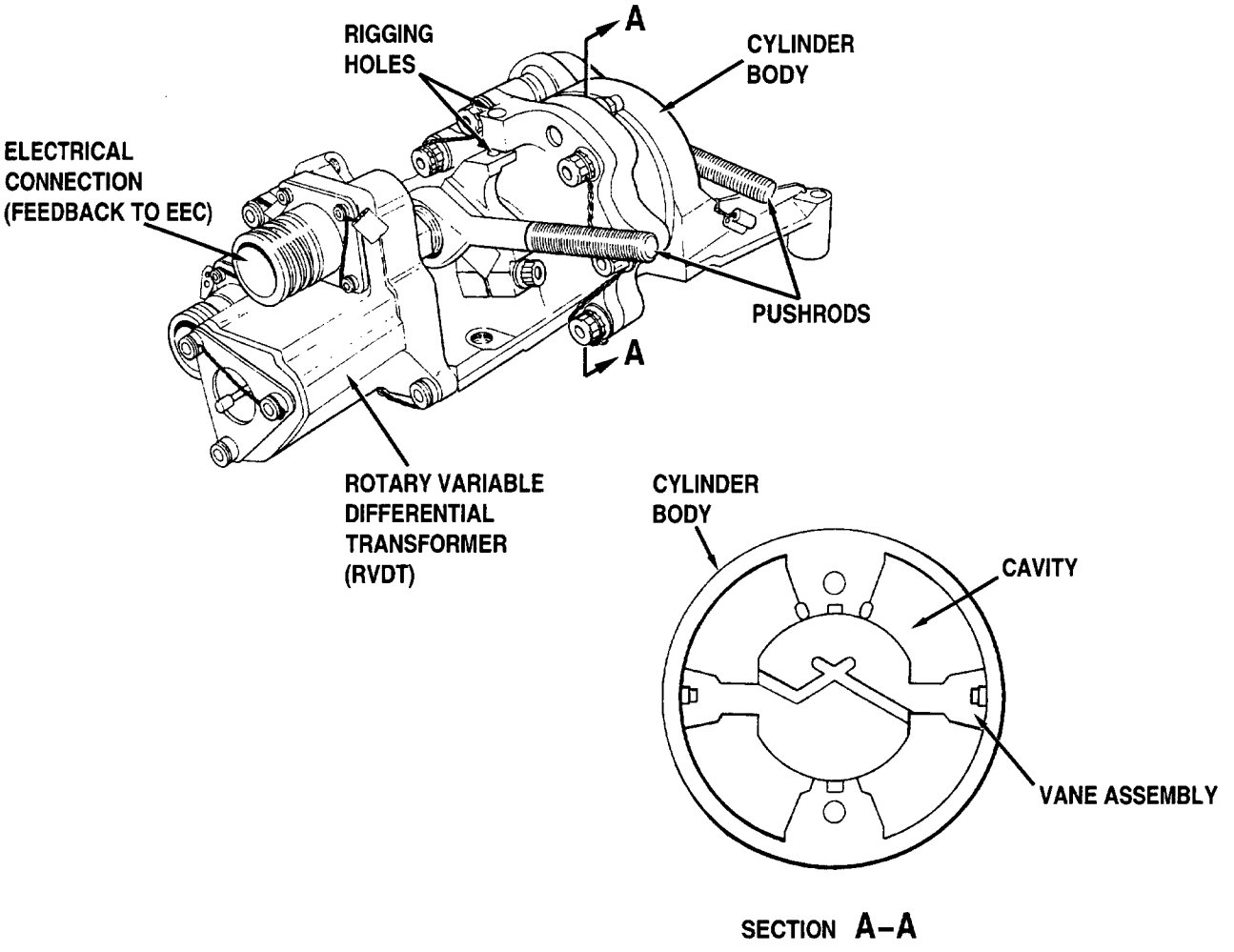
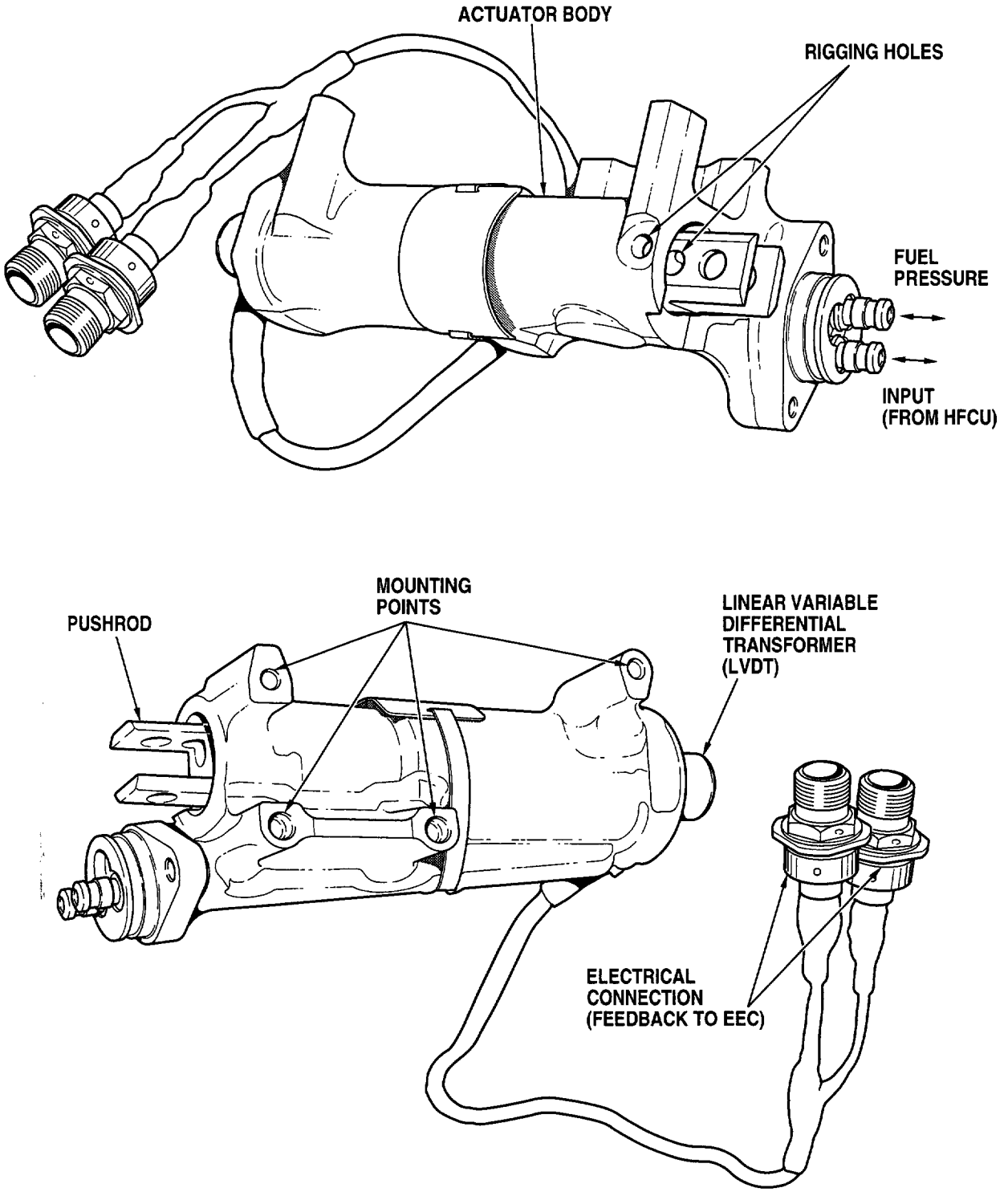
Compressor Bleed Solenoid Valve
Figure 3



Rotary Stator Vane Actuator Pre-SB24369
Figure 4



Linear Stator Vane Actuator - Post-SB24369
Figure 5

TABLE OF CONTENTS

SUBJECT	PAGE
ANTI-ICING VALVE - MAINTENANCE PRACTICES	**75-10-01**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Anti-ice Solenoid Valve	201
A. Removal	201
B. Installation	203
CABIN BLEED AIR - MAINTENANCE PRACTICES	**75-10-02**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Cabin Bleed Air Tubes	201
A. Removal	201
B. Installation	205

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Nov 09/2007
	2 blank	Nov 09/2007
Contents	1	Nov 09/2007
	2 blank	Nov 09/2007
75-10-01	201	Sep 06/2002
Maintenance	202	Sep 06/2002
Practices	203	Sep 06/2002
	204	Sep 06/2002
75-10-02	201	Nov 09/2007
Maintenance	202	Nov 09/2007
Practices	203	Nov 09/2007
	204	Nov 09/2007
	205	Nov 09/2007
	206 blank	Nov 09/2007

ANTI-ICING VALVE - MAINTENANCE PRACTICES

1. General

   A. Use engine oil to lubricate preformed packings, threads and mating surfaces, unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after sub-assembly.

2. Consumable Materials

   Not Applicable

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Anti-ice Solenoid Valve

   A. Removal (Ref. Fig. 201)

   CAUTION: ENSURE AIRFRAME ELECTRICAL POWER IS OFF WHEN HANDLING ELECTRICAL CONNECTORS.

   CAUTION: ENSURE CONNECTOR PLUGS ARE FREE OF MOISTURE; IF NECESSARY, DRY USING HEAT GUN.

   CAUTION: DO NOT FORCE OR STRETCH HARNESS WHEN INSTALLING CONNECTORS OR SECURING LOOP CLAMPS.

   CAUTION: USE ONLY APPROVED TOOLS TO TIGHTEN HARNESS CONNECTORS. CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY BLUE COLOR BAND IS VISIBLE; RED COLOR BAND MUST NOT BE VISIBLE.

   (1) Select maintenance test discrete ON before anti-ice solenoid valve removal (Ref. Aircraft Maintenance Manual).

   (2) Remove engine nacelle, sufficient to gain access to engine by-pass duct (Ref. Aircraft Maintenance Manual).

   (3) Remove upper portion of by-pass duct (inner and outer) (Ref. 72-70-01).

   (4) Remove two bolts (1) securing P3 tube assembly (2) to solenoid valve (3).

   (5) Disconnect electrical connector P18 (4) at solenoid valve.

   (6) Remove two nuts (5), bolts (6) and retaining plate (7).

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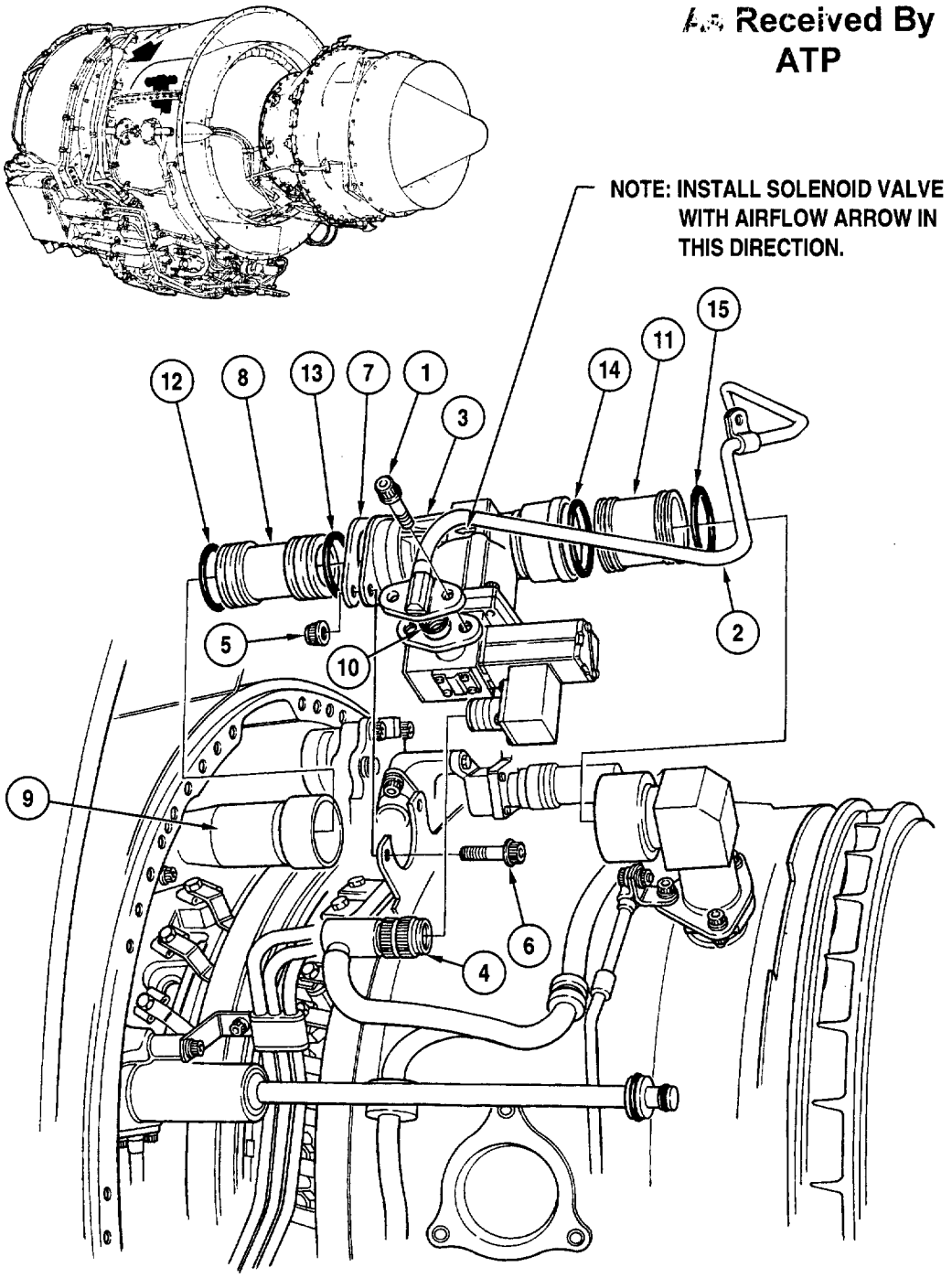

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Anti-ice Solenoid Valve Removal/Installation
Figure 201

Key to Figure 201

1. Bolt
2. P3 Tube Assembly
3. Anti-ice Solenoid Valve
4. Electrical Connector P18
5. Nut
6. Bolt
7. Retaining Plate
8. Transfer Tube
9. Anti-icing Tube
10. Gasket
11. Transfer Tube
12. Preformed Packing/Seal
13. Preformed Packing/Seal
14. Preformed Packing/Seal
15. Preformed Packing/Seal

(7) Remove the retaining ring (13) from groove on downstream tube and slide it back onto the tube body.

(8) Slide transfer tube (8) part way into anti-icing tube (9), remove solenoid valve (3) together with gasket (10), discard gasket.

CAUTION: DO NOT PRY ON HP COMPRESSOR CASE MOUNTED ELBOW TO ASSIST REMOVAL OR INSTALLATION OF VALVE.

(9) Remove transfer tubes (8) and (11), remove and discard preformed packings and/or seals (12, 13, 14 and 15).

B. Installation (Ref. Fig. 201)

(1) Pre-SB24194 : Lubricate and install new preformed packings (12, 13, 14, 15) on transfer tubes (8) and 11).

CAUTION: DO NOT LUBRICATE PLAIN SEALS.

(2) Post-SB24194 : Install new plain seals (12, 13, 14, 15) on transfer tubes (8) and 11). Install open end of seals toward open end of tube.

CAUTION: DO NOT LUBRICATE PLAIN SEALS.

(3) Post-SB24259 : Lubricate and install two new preformed packings (14) and (15) on transfer tube (11). Install two new plain seals (12, 13) on transfer tube (8). Install open end of seals toward open end of tube.

(4) Install transfer tube (11).

(5) Slide transfer tube (8) part way into anti-icing tube (9).

(6) Insert gasket (10) into recess of solenoid valve (3).

(7) Note position of airflow arrow on solenoid valve (3) and install valve onto transfer tube (11). Slide transfer tube (8) into open end of solenoid valve.

CAUTION: DO NOT LUBRICATE THREADS.

(8) Install retaining plate (7) and secure using two bolts (6) and nuts (5), torque nuts 27 to 30 lb.in. (3.0-3.4 Nm).

CAUTION: USE ONLY APPROVED TOOLS TO TIGHTEN WIRING HARNESS CONNECTORS. CONNECTORS ARE FULLY TIGHTENED WHEN ONLY THE BLUE COLOR BAND IS VISIBLE, RED COLOR BAND MUST NOT BE VISIBLE.

(9) Install electrical connector P18 (4) onto solenoid valve. Torque connector P18 (4) 24 to 29 lb.in. (2.7-3.3 Nm).

(10) Secure P3 tube assembly (2) to solenoid valve using two bolts (1), torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(11) Assemble by-pass duct (Ref. 72-70-01).

(12) Assemble engine nacelle (Ref. Aircraft Maintenance Manual).

(13) Restore electrical power to appropriate system and reset EEC circuit breaker to ON.

(14) Select maintenance test discrete to OFF.

(15) Refer to Chapter 71-00-00 for checks following installation of anti-ice solenoid valve.

(16) Restore aircraft to normal operating condition (Ref. Aircraft Maintenance Manual).

CABIN BLEED AIR - MAINTENANCE PRACTICES

1. General

   A. Use engine oil to lubricate preformed packings, threads and mating surfaces, unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after sub-assembly.

2. Consumable Materials

   Not Applicable

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC60714	Puller

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Cabin Bleed Air Tubes

   A. Removal (Ref. Fig. 201)

      NOTE: The following procedure applies to either the right or left-hand cabin bleed air tube assembly.

      (1) Remove six bolts (2 or 7), LP bleed pad cover (3), or shipping cover (8) and cabin air tube retainer (9), as applicable, and LP bleed pad gasket (4). Discard gasket (4).

      (2) Remove cabin air bleed tube assembly (6) with puller (PWC60714). Remove and discard preformed packings (1 and 5).

      (3) Repeat steps (1 and 2) to remove cabin air bleed tube assembly (6) from opposite side of engine.

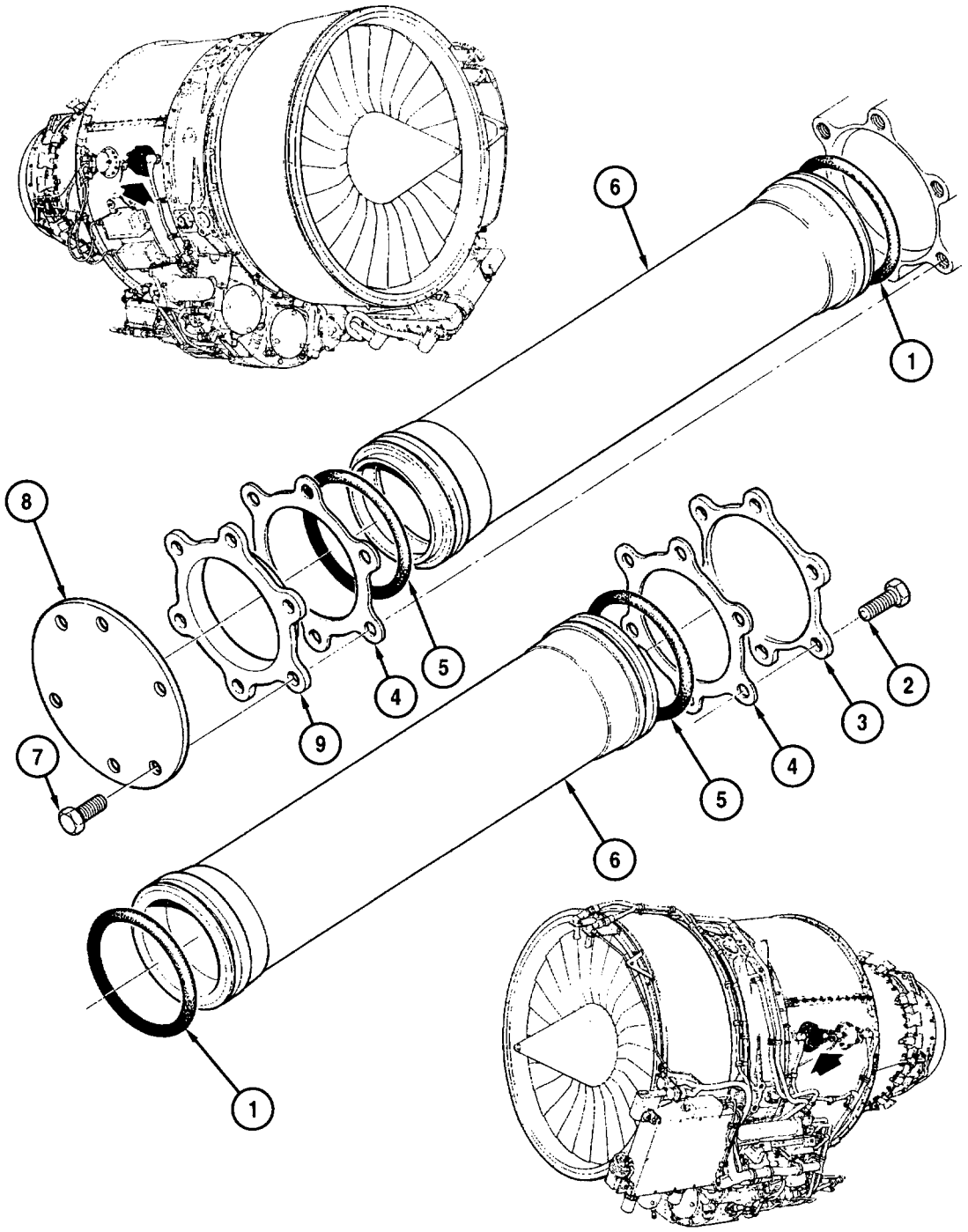
      (4) Place protective covers on cabin air bleed covers and store in sealable plastic bags.

      (5) Remove five bolts (10) and shipping cover from HP bleed air tube (11).

      (6) Remove two bolts (14) securing HP bleed air tube (11) to compressor case.

      (7) Remove HP bleed air tube (11). Remove and discard gaskets (12 and 13).

      (8) Repeat steps (5), (6) and (7) to remove remaining HP bleed air tube.

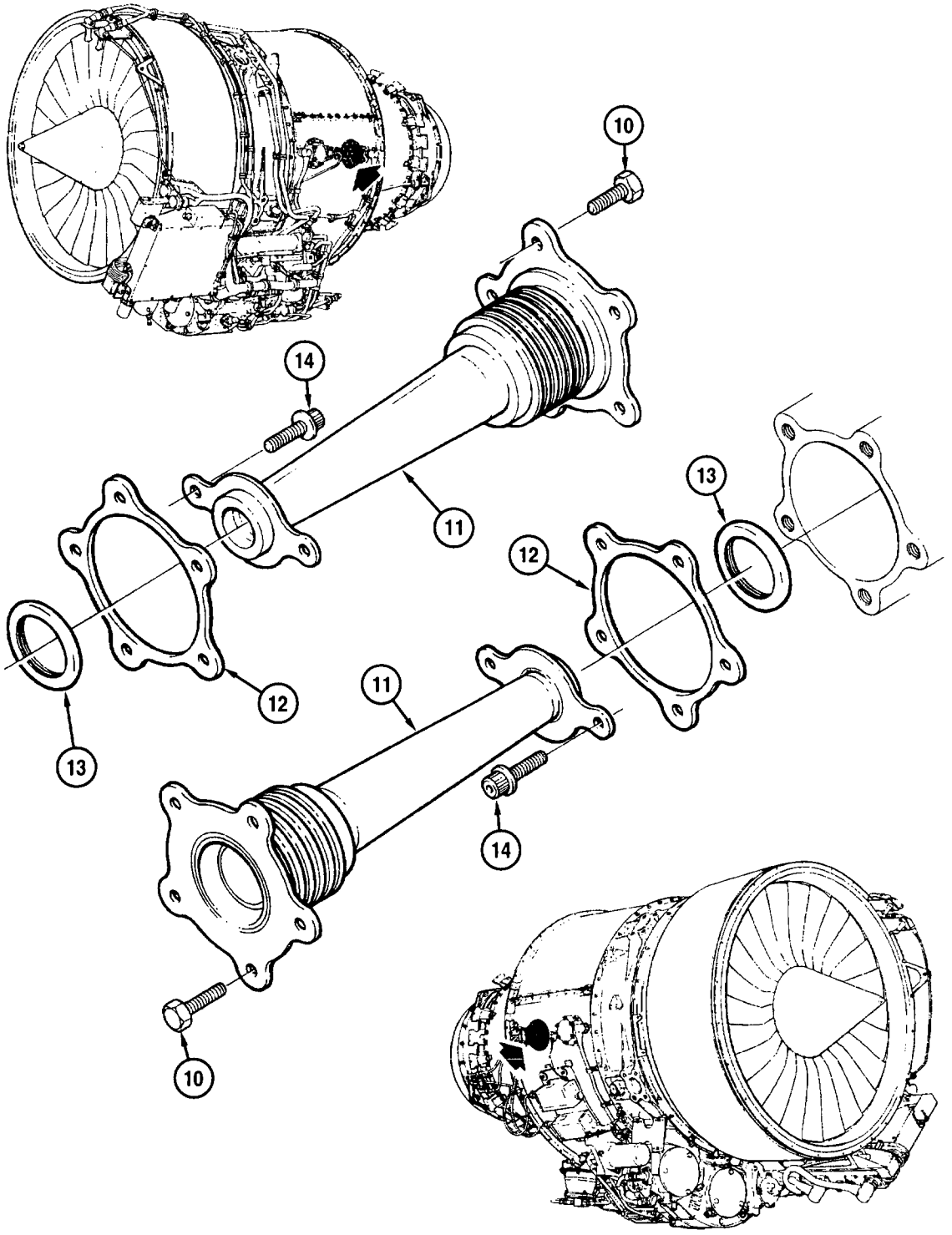


C20535

Cabin Bleed Air Tubes - Removal/Installation
Figure 201 (Sheet 1 of 2)

Key to Figure 201

1. Preformed Packing
2. Bolt
3. LP Bleed Pad Cover
4. Gasket
5. Preformed Packing
6. Cabin Air Bleed Tube Assembly
7. Bolt
8. Shipping Cover
9. Cabin Air Tube Retainer
10. Bolt
11. HP Bleed Air Tube
12. Gasket
13. Metal Gasket
14. Bolt



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Cabin Bleed Air Tubes - Removal/Installation
Figure 201 (Sheet 2)

(9) Place protective covers on bleed air tubes. Store tubes in sealable plastic containers.

B. Installation (Ref. Fig. 201)

NOTE: Although cabin air can be taken from either the left or right-hand side of the engine, the cabin air tube retainer (9) is normally installed on the engine left-hand side at engine assembly.

(1) Lubricate new preformed packings (1 and 5) and install on cabin air bleed tube assembly (6).

(2) Install cabin air bleed tube assembly through right-hand LP bleed pad on outer bypass duct; ensure tube is seated in bleed air boss on gas generator case.

(3) Install gasket (4) and cover (3) on LP bleed pad and secure with six bolts (2). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(4) Lubricate preformed packings (1 and 5) and install on remaining cabin air bleed tube assembly (6).

(5) Install cabin air bleed assembly (6) through left-hand LP bleed pad on outer bypass duct; ensure tube is seated in bleed air boss on gas generator.

(6) Install new gasket (4), cabin air tube retainer (9) and shipping cover (8) on LP bleed pad and secure with six bolts (7). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(7) Install new gasket (12) and metal gasket (13) over HP air bleed tube (11).

(8) Install HP bleed tube (11) through right-hand HP bleed pad on outer bypass duct, and secure with two bolts (14). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(9) Secure outer flange of HP bleed tube (11) to bleed pad on outer bypass duct with five bolts (10). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(10) Repeat steps (7), (8) and (9) to install left-hand HP bleed tube (11).

(11) Place protective covers over right and left-hand HP bleed tubes.

TABLE OF CONTENTS

SUBJECT	PAGE
COMPRESSOR BLEED VALVES - MAINTENANCE PRACTICES	**75-30-01**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. P2.5 Compressor Bleed Valves	201
A. Removal of Right Side Bleed Valve	201
B. Installation of Right Side Bleed Valve	204
C. Removal of Left Side Bleed Valve	204
D. Installation of Left Side Bleed Valve	204
6. P2.8 Compressor Bleed Valves	205
A. Removal	205
B. Installation	205
7. P2.5 Compressor Bleed Valves	206
A. Disassembly (Pre-SB24186 or Post-SB24318 or Post-SB24323)	206
B. Disassembly (Post-SB24186 or Pre-SB24318 or Post-SB24323)	206
C. Assembly (Pre-SB24186 or Post-SB24318 or Post-SB24323)	210
D. Assembly (Post-SB24186 or Pre-SB24318 or Pre-SB24323)	210
8. P2.8 Compressor Bleed Valves	210
A. Disassembly (Pre-SB24186 or Post-SB24318 or Post-SB24323)	210
B. Disassembly (Post-SB24186 or Pre-SB24318 or Pre-SB24323)	217
C. Disassembly (Post-SB24323)	217
D. Examine Valve Seating	217
E. Lap Valve and Seat	219
F. Assembly (Pre-SB24186 or Post-SB24318 or Post-SB24323)	219
G. Assembly (Post-SB24186 or Pre-SB24318 or Pre-SB24323)	223

TABLE OF CONTENTS

SUBJECT	PAGE
COMPRESSOR BLEED VALVES - MAINTENANCE PRACTICES (Cont'd)	**75-30-01**
H. Assembly (Post-SB24323)	223
9. Cleaning	223
A. Compressor Bleed Valves	223
10. Inspection/Check	224
A. Compressor Bleed Valve Housing	224
B. Compressor Bleed Valve Cover Assembly	224
C. Compressor Bleed Valve Piston	227
D. Sleeve Spacer	227
E. Flange Adapter	227
F. Metal Seal Ring	231
11. Fits, Clearances and Torque Loadings	233
BOV SOLENOID VALVE - MAINTENANCE PRACTICES	**75-30-02**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Compressor Bleed Solenoid Valve	201
A. Removal)	201
B. Installation)	204
P3 TUBES - MAINTENANCE PRACTICES	**75-30-03**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201

TABLE OF CONTENTS

SUBJECT	PAGE
P3 TUBES - MAINTENANCE PRACTICES (Cont'd)	**75-30-03**
5. P3 Tubes and Transducer	201
A. Remove P3 Tubes (Pre-SB24434/Post-SB24514)	201
B. Install P3 Tubes (Pre-SB24434/Post-SB24514)	201
C. Remove P3 Tubes and Transducer (Post-SB24434/Pre-SB24514)	203
D. Install P3 Tubes and Transducer (Post-SB24434/Pre-SB24514)	205
VIGV ACTUATOR - MAINTENANCE PRACTICES	**75-30-04**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Rotary Stator Vane Actuator (Pre-SB24369)	201
A. Removal	201
B. Installation	204
C. Rigging Procedure	204
6. Linear Stator Vane Actuator (Post-SB24369)	208
A. Remove Linear Stator Vane Actuator (Post-SB24369)	208
B. Disassembly of Linear Stator Vane Actuator Lever (Post-SB24502)	212
C. Assembly of Linear Stator Vane Actuator Lever (Post-SB24502)	213
D. Removal of Rod End Connectors (Post-SB24502)	213
E. Installation of Rod End Connectors (Post-SB24502)	213
F. Installation of Linear Stator Vane Actuator (Post-SB24369)	215
G. Adjust Linear Stator Vane Actuator Linkage (Post-SB24369)	218
7. Fits, Clearances and Torque Loadings	218
A. General	218

TABLE OF CONTENTS

SUBJECT	PAGE
VIGV ACTUATOR - MAINTENANCE PRACTICES (Cont'd)	**75-30-04**
B. Dimensional Checks	218
C. Torque Limits	218

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	May 30/2008
	2	May 30/2008
Contents	1	May 30/2008
	2	May 30/2008
	3	May 30/2008
	4	May 30/2008
75-30-01 Maintenance Practices	201	Feb 15/2008
	202	Feb 15/2008
	203	Feb 15/2008
	204	Feb 15/2008
	205	Feb 15/2008
	206	Feb 15/2008
	207	Feb 15/2008
	208	Feb 15/2008
	209	Feb 15/2008
	210	Feb 15/2008
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	235	Feb 15/2008
	236	Feb 15/2008
	237	Feb 15/2008
	238	Feb 15/2008
	239	Feb 15/2008
	240	Feb 15/2008
	241	Feb 15/2008
	242 blank	Feb 15/2008
75-30-02 Maintenance Practices	201	Nov 19/99
	202	Nov 19/99
	203	Nov 19/99
	204	Nov 19/99
	205	Nov 19/99
	206 blank	Nov 19/99
75-30-03 Maintenance Practices	201	Feb 15/2008
	202	Feb 15/2008
	203	Feb 15/2008
	204	Feb 15/2008
	205	Feb 15/2008
	206	Feb 15/2008
75-30-04 Maintenance Practices	201	May 30/2008
	202	May 30/2008
	203	May 30/2008
	204	May 30/2008
	205	May 30/2008
	206	May 30/2008
	207	May 30/2008
	208	May 30/2008
	209	May 30/2008
	210	May 30/2008
	211	May 30/2008
	212	May 30/2008
	213	May 30/2008
	214	May 30/2008
	215	May 30/2008
	216	May 30/2008
	217	May 30/2008

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
	218	May 30/2008
	219	May 30/2008
	220	May 30/2008
	221	May 30/2008
	222	May 30/2008
	223	May 30/2008
	224	May 30/2008
	225	May 30/2008
	226 blank	May 30/2008

COMPRESSOR BLEED VALVES - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC05-041	Dye, Layout
PWC05-089	Lockwire
PWC06-004	Compound, Anti-seize
PWC11-012	Solvent
PWC11-014	Solvent

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC60149	Lapping Tool
PWC60158	Holding Fixture

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. P2.5 Compressor Bleed Valves

   A. Removal of Right Side Bleed Valve (Ref. Fig. 201)

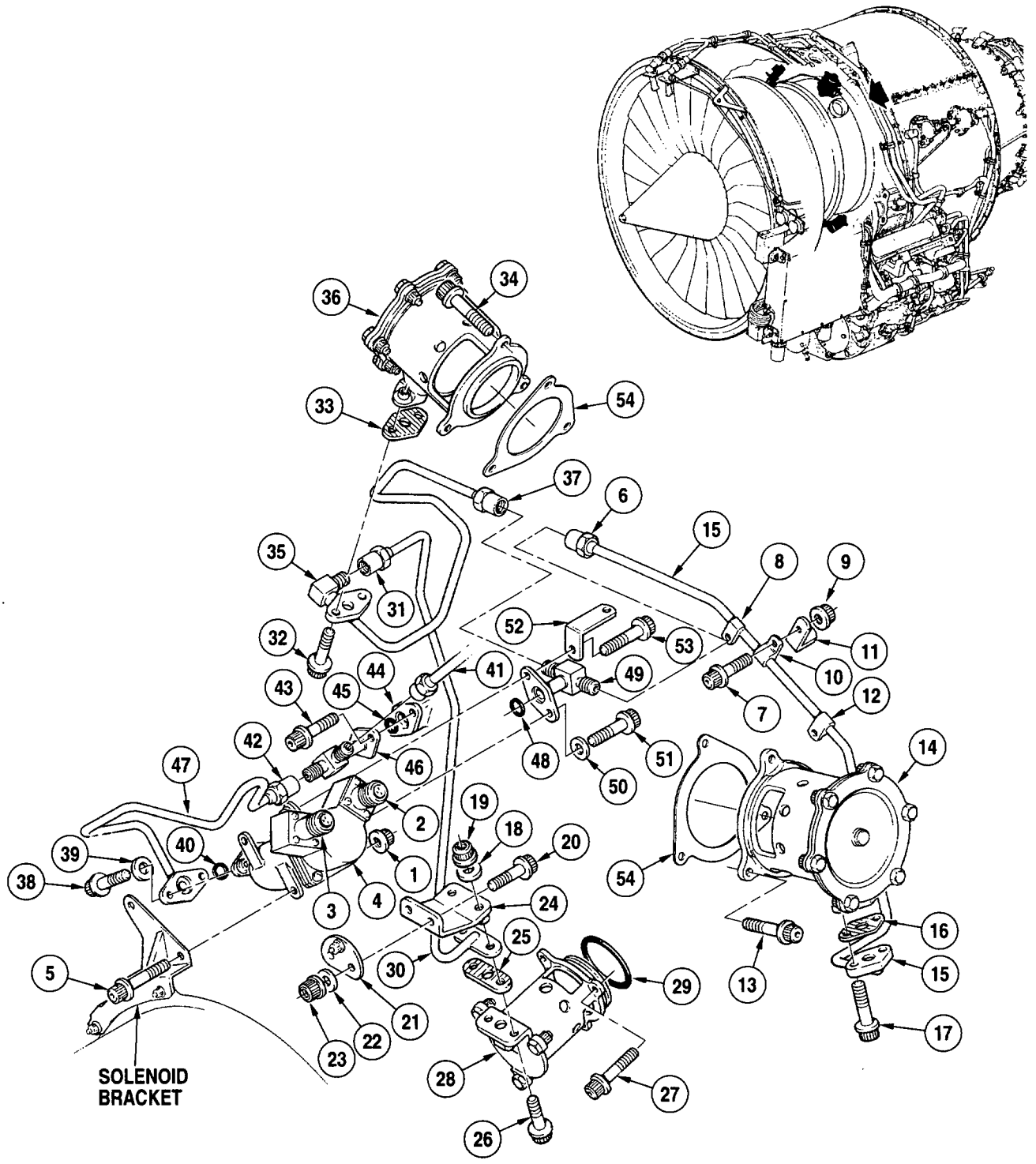
      (1) Remove outer bypass duct, upper half, and inner bypass duct, upper right segment (Ref. 72-70-01).

      (2) Disconnect coupling nuts (37 and 31).

      (3) Remove two bolts (32), tube assembly (35) and gasket (33).

      (4) Remove three bolts (34) and compressor bleed valve (36).

      (5) Post-SB24269: Remove and discard gasket (54).



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P2.5 Bleed Valves - Removal/Installation
Figure 201

Key to Figure 201

1. Self-locking Nut
2. P14 Receptacle
3. P13 Receptacle
4. Compressor Bleed Valve Solenoid
5. Bolt
6. Coupling Nut
7. Bolt
8. Bracket
9. Self-locking Nut
10. Loop Clamp
11. Bracket
12. Bracket
13. Bolt
14. Compressor Bleed Valve Assembly
15. Tube Assembly
16. Gasket
17. Bolt
18. Washer
19. Self-locking Nut
20. Bolt
21. Bracket
22. Washer
23. Self-locking Nut
24. Bracket Assembly
25. Gasket
26. Bolt
27. Bolt
28. Compressor Bleed Valve Assembly
29. Preformed Packing
30. P3 Air Bleed Tube Assembly
31. Coupling Nut
32. Bolt
33. Gasket
34. Bolt
35. Tube Assembly
36. Compressor Bleed Valve Assembly
37. Coupling Nut
38. Bolt
39. Washer
40. Gasket
41. Coupling Nut
42. Coupling Nut
43. Bolt
44. Flange
45. Gasket
46. Adapter
47. Tube Assembly (P3 to Solenoid Valve)
48. Gasket
49. Adapter
50. Washer
51. Bolt
52. Bracket
53. Bolt
54. Gasket (Post-SB24269)

B. Installation of Right Side Bleed Valve (Ref. Fig. 201)

(1) Pre-SB24269: Secure bleed valve (36) to boss on compressor case using three bolts (34). Tighten bolts evenly in a star pattern and torque to 36 to 40 lb.in. (4.0-4.6 Nm).

(2) Post-SB24269: Install gasket (54) and secure bleed valve (36) to boss on compressor case using three bolts (34). Tighten bolts evenly in a star pattern and torque to 36 to 40 lb.in. (4.0-4.6 Nm).

(3) Install tube assembly (35) on bleed valve (36) with new gasket (33). Secure tube assembly using two bolts (32). Torque bolts to 36 to 40 lb.in. (4.0-4.6 Nm).

(4) Secure coupling nut (31) to tube assembly (35). torque to 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(5) Secure coupling nut (37) to adapter (49). Torque coupling nut to 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(6) Install inner and outer bypass ducts (Ref. 72-70-01).

C. Removal of Left Side Bleed Valve (Ref. Fig. 201)

(1) Remove outer bypass duct, upper half, and inner bypass duct upper segments (Ref. 72-70-01).

(2) Disconnect loop clamps securing front core wiring harness to brackets (8 and 12) (Ref. 73-20-03).

(3) Remove self-locking nut (9), bolt (7) and loop clamp (10).

(4) Remove two bolts (17) and gasket (16).

(5) Disconnect coupling nut (6) and remove tube assembly (15).

(6) Remove three bolts (13) and bleed valve (14).

(7) Post-SB24269: Remove and discard gasket (54).

D. Installation of Left Side Bleed Valve (Ref. Fig. 201)

(1) Pre-SB24269: Secure bleed valve (14) to boss on compressor case using three bolts (34). Tighten bolts evenly in a star pattern and torque to 36 to 40 lb.in. (4.0-4.6 Nm).

(2) Post-SB24269: Install gasket (54) and secure bleed valve (14) to boss on compressor case using three bolts (34). Tighten bolts evenly in a star pattern and torque to 36 to 40 lb.in. (4.0-4.6 Nm).

(3) Position loop clamp (10) on tube assembly (15) and position tube assembly on engine.

(4) Install new gasket (16) on tube assembly (15) and secure tube assembly to bleed valve (14) using two bolts (17). Torque bolts to 36 to 40 lb.in. (4.0-4.6 Nm).

(5) Secure coupling nut (6) to adapter (49). Torque coupling nut to 90 to 100 lb.in. (10.0-11.0 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(6) Secure loop clamp (10) to bracket (11) using bolt (7) and self-locking nut (9). Torque nut to 27 to 30 lb.in. (3.0-3.4 Nm).

(7) Secure loop clamp on front core wiring harness to brackets (8 and 12) (Ref. 73-20-03).

(8) Install inner and outer bypass ducts (Ref. 72-70-01).

(9) Refer to (Ref. 71-00-00) for checks following installation of P2.5 compressor bleed valve.

6. P2.8 Compressor Bleed Valves

A. Removal (Ref. Fig. 201)

(1) Remove outer bypass duct, upper half, and inner bypass ducts on the right side (Ref. 72-70-01).

(2) Remove P2.5 cabin bleed tube right side (Ref. 75-10-01).

(3) Remove two self-locking nuts (19), two washers (18), two bolts (26) and gasket (25).

(4) Disconnect coupling nut (31) and remove tube assembly (30).

(5) Remove three bolts (27) and bleed valve (28). Remove and discard preformed packing (29).

(6) Remove two self-locking nuts (23), two washers (22), two bolts (20) and bracket (24).

B. Installation (Ref. Fig. 201)

CAUTION: DO NOT LUBRICATE THREADS.

(1) Position bracket (24) on bracket (21). Secure bracket (24) using two bolts (20), two washers (22) and two self-locking nuts (23). Torque self-locking nuts to 27 to 30 lb.in. (3.0-3.4 Nm).

(2) Position tube assembly (30) on engine. Tighten coupling nut (31) to hold tube assembly in position.

(3) Install bleed valve assembly on compressor case with new preformed packing (29). Secure bleed valve to compressor case with three bolts (27). Torque bolts to 27 to 30 lb.in. (3.0-3.4 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(4) Install gasket (25) between bleed valve (28) and tube assembly (30). Secure gasket (25), tube assembly (30) and bracket (24) to bleed valve (28) using two bolts (26), two washers (18) and two self-locking nuts (19). Torque nuts to 27 to 30 lb.in. (3.0-3.4 Nm).

(5) Loosen coupling nut (31). Torque coupling nuts to (31) 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(6) Install inner and outer bypass ducts (Ref. 72-70-01).

(7) Refer to Chapter 71-00-00 for checks following installation of P2.8 compressor bleed valve.

7. P2.5 Compressor Bleed Valves

A. Disassembly (Pre-SB24186 or Post-SB24318 or Post-SB24323) (Ref. Fig. 202)

(1) Remove six bolts (1) and six self-locking nuts (9) that attach cover assembly (2).

(2) Remove cover assembly (2) and gasket (3). Discard gasket (3).

(3) Remove piston assembly (11) from housing assembly (10).

(4) Remove plastic seal ring (4) and metallic seal ring (5) from piston (8).

(5) Remove retaining ring (6) and sleeve spacer (7) from piston (8).

B. Disassembly (Post-SB24186 or Pre-SB24318 or Post-SB24323) (Ref. Fig. 202)

(1) Remove three screws (14) that attach bleed valve housing assembly (10) to bleed valve seat (13).

(2) Remove valve housing assembly (10).

(3) Remove bleed valve piston assembly (11) from valve housing.

(4) Pre-SB24283 and Pre-SB24312:

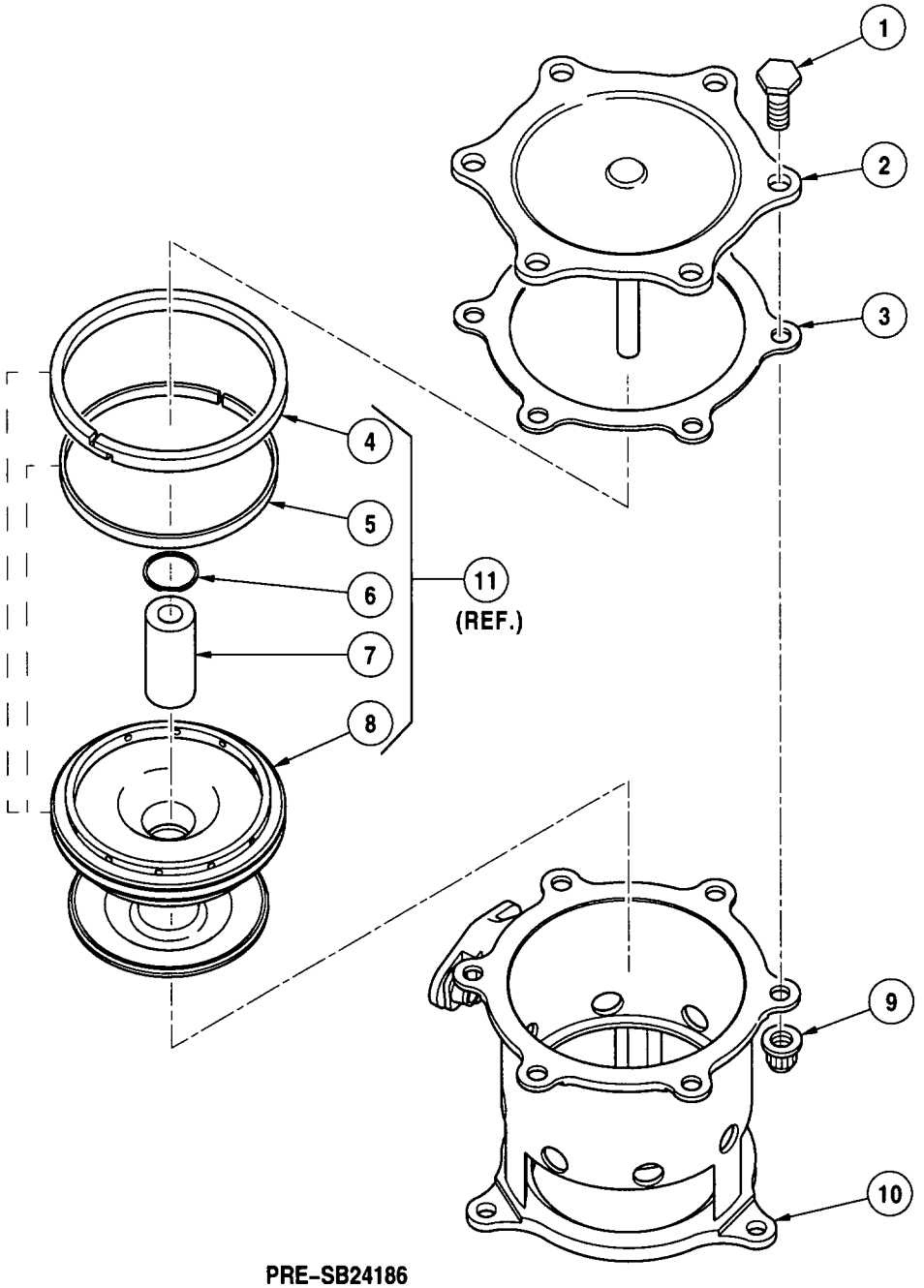
(a) Remove plastic seal ring (4) and metal seal ring (5) from piston (8).

(5) Post-SB24283 and Post-SB24312:

(a) Remove seal ring (15) from piston (8).

(6) Remove retaining ring (6) and sleeve spacer (7) from piston.

(7) Remove helical spring (12) from valve seat (13).



PRE-SB24186
POST-SB24318
POST-SB24323

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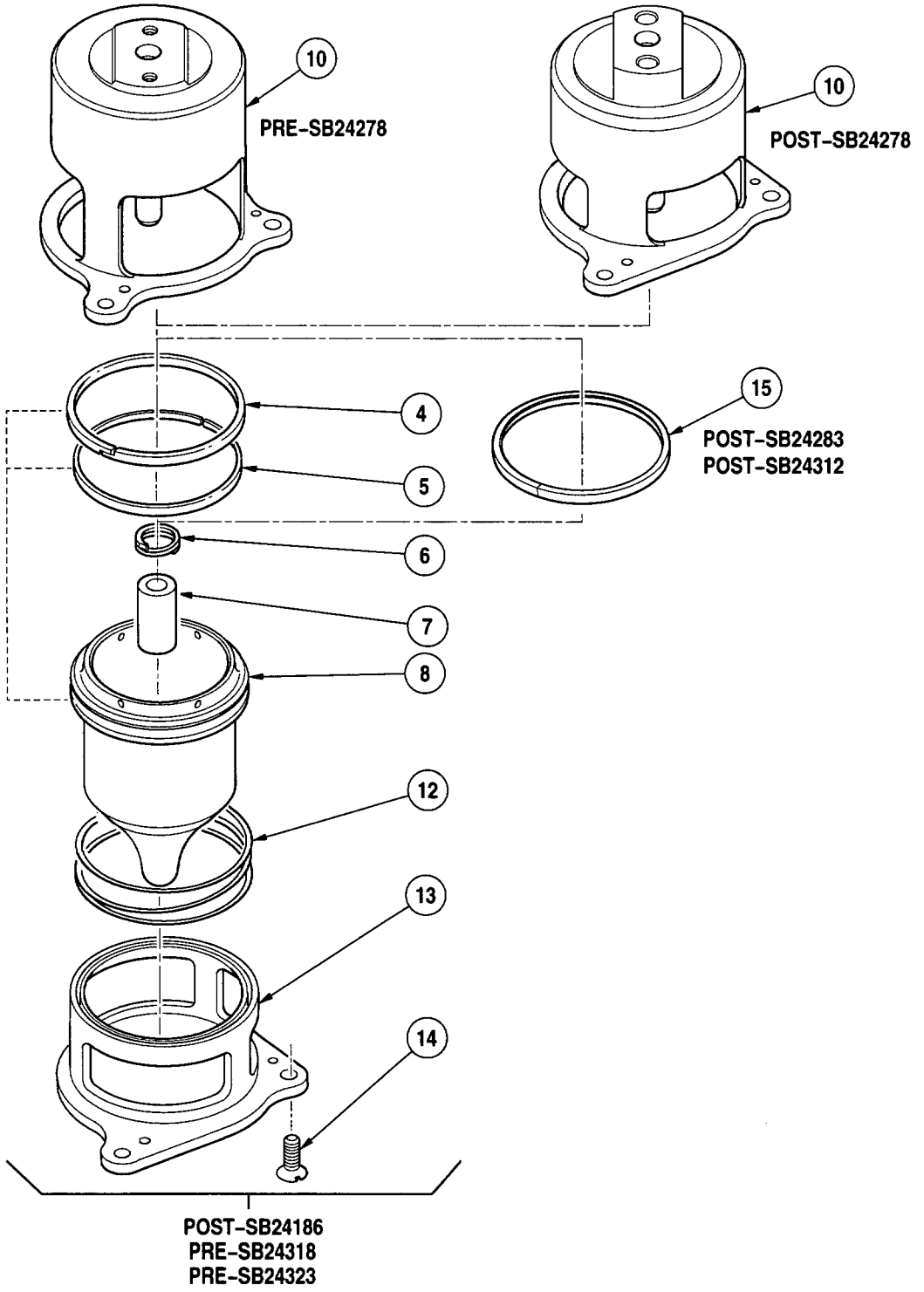
P2.5 Bleed Off Valve Assembly - Disassembly/Assembly
Figure 202 (Sheet 1 of 2)

Key to Figure 202

1. Bolt (Pre-SB24186 or Post-SB24318 or Post-SB24323)
2. Compressor Bleed Valve Cover Assembly (Pre-SB24186 or Post-SB24318 or Post-SB24323)
3. Gasket (Pre-SB24186 or Post-SB24318 or Post-SB24323)
4. Plastic Seal Ring (Pre-SB24283 and Pre-SB24312)
5. Metal Seal Ring (Pre-SB24283 and Pre-SB24312)
6. Retaining Ring
7. Sleeve Spacer
8. Compressor Bleed Valve Piston
9. Self-locking Nut (Pre-SB24186 or Post-SB24318 or Post-SB24323)
10. P2.5 Compressor Bleed Valve Housing Assembly
11. Compressor Bleed Valve Piston Assembly (Ref.)
12. Helical Spring (Post-SB24186 or Pre-SB24318 or Pre-SB24323)
13. Compressor Bleed Valve Seal (Post-SB24186 or Pre-SB24318 or Pre-SB24323)
14. Screw (Post-SB24186 or Pre-SB24318 or Pre-SB24323)
15. Seal Ring (Post-SB24283 and Post-SB24312)



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P2.5 Bleed Off Valve Assembly - Disassembly/Assembly
Figure 202 (Sheet 2)

C. Assembly (Pre-SB24186 or Post-SB24318 or Post-SB24323) (Ref. Fig. 203)

(1) Install sleeve spacer (7), chamfered end down, in compressor bleed valve piston (8). Attach with retaining ring (6).

(2) Install metal seal ring (5) in compressor bleed valve piston (8).

(3) Install new plastic seal ring (4) in compressor bleed valve piston (8). Put ring gap 180 degrees ± 20 degrees away from gap in metal seal ring (5).

(4) Install compressor bleed valve assembly (11) in P2.5 compressor bleed valve housing (10).

(5) Install one new gasket (3) and compressor bleed valve cover assembly (2) on P2.5 compressor bleed valve housing (10). Attach with six bolts (1) and six self-locking nuts (9). Torque self-locking nuts to 36 to 40 lb.in. (4.1-4.6 Nm) in a star pattern.

D. Assembly (Post-SB24186 or Pre-SB24318 or Pre-SB24323) (Ref. Fig. 203)

(1) Install sleeve spacer (7), chamfered end down, in compressor bleed valve piston (8). Attach with retaining ring (6).

(2) Install metal seal ring (5) in compressor bleed valve piston (8).

(3) Install new plastic seal ring (4) in compressor bleed valve piston (8). Put ring gap 180 degrees ± 20 degrees away from gap in metal seal ring (5).

CAUTION: MAKE SURE HELICAL SPRING IS ASSEMBLED ON THE CORRECT SIDE OF THE PISTON.

(4) Install helical spring (12) into groove of piston (8).

(5) Install compressor bleed valve assembly (11) in P2.5 compressor bleed valve housing (10).

(6) Install piston (8) into bleed valve housing (10).

(7) Install bleed valve seat (13). Apply anti-seize compound (PWC06-004) to the threads of screw (14) and attach bleed valve seat to bleed valve housing (10). Torque screws to 10 to 11.5 lb.in. (1.1-1.3 Nm).

8. P2.8 Compressor Bleed Valves

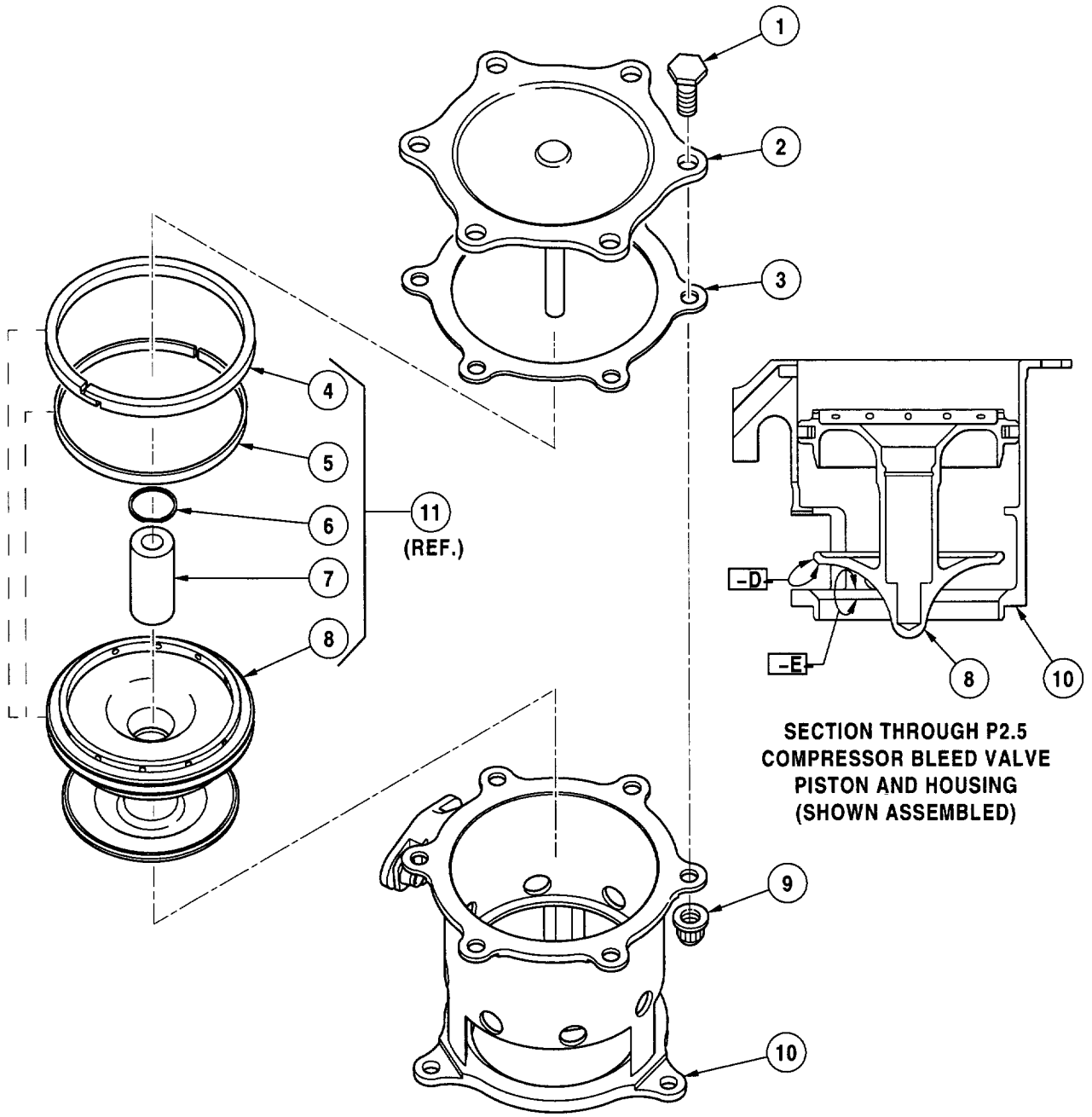
A. Disassembly (Pre-SB24186 or Post-SB24318 or Post-SB24323) (Ref. Fig. 204)

(1) Remove three bolts (1) and three self-locking nuts (11) that attach cover assembly (2).

(2) Remove cover assembly (2) and gasket (3). Discard gasket.

(3) Remove piston assembly (12) from housing assembly (10).

(4) Remove non-metallic seal ring (4) and metallic seal ring (5) from piston (8).



SECTION THROUGH P2.5
COMPRESSOR BLEED VALVE
PISTON AND HOUSING
(SHOWN ASSEMBLED)

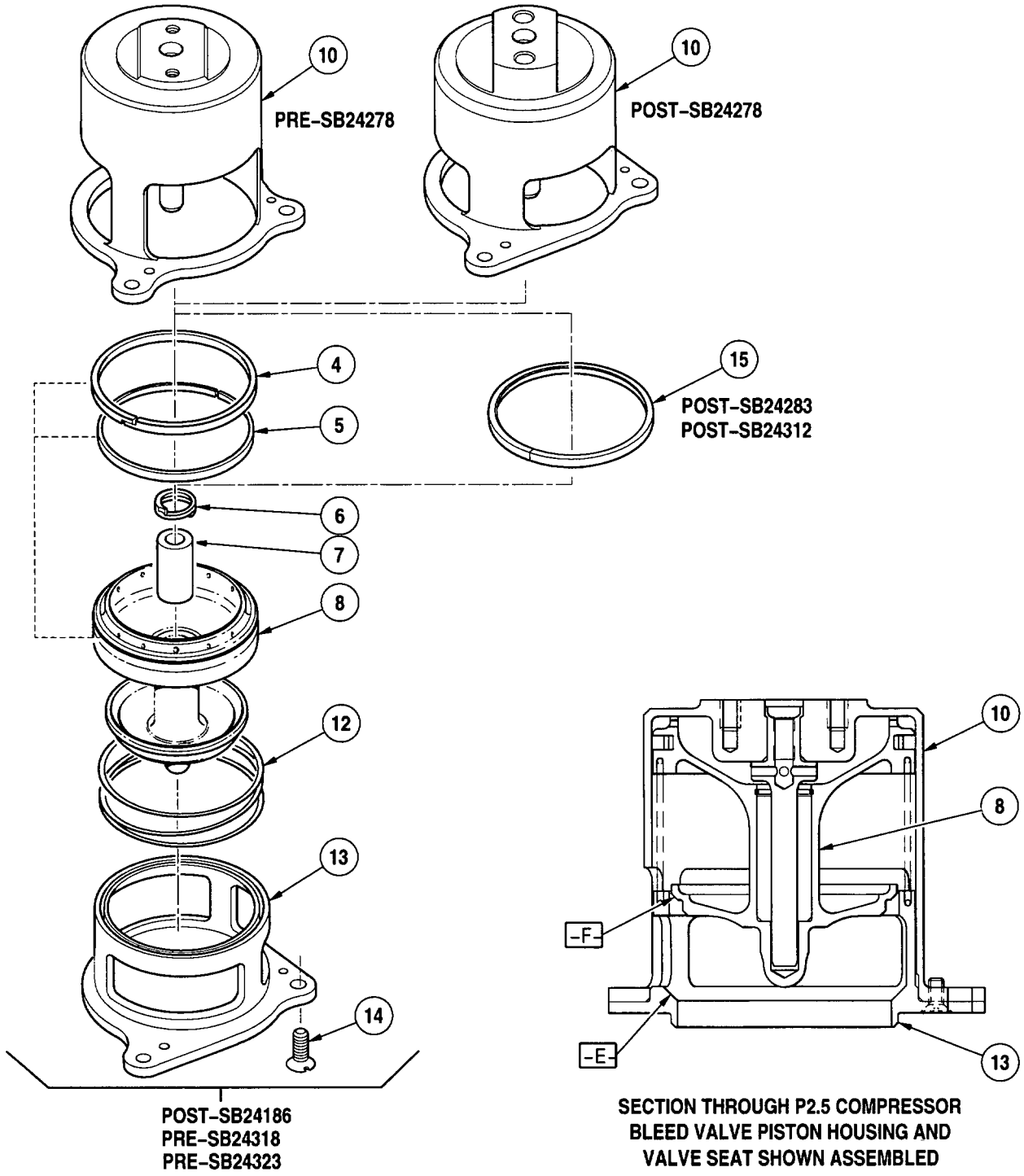
PRE-SB24186
POST-SB24318
POST-SB24323

C32832B

Disassembly/Assembly of P2.5 Compressor Bleed Valve Assembly
Figure 203 (Sheet 1 of 2)

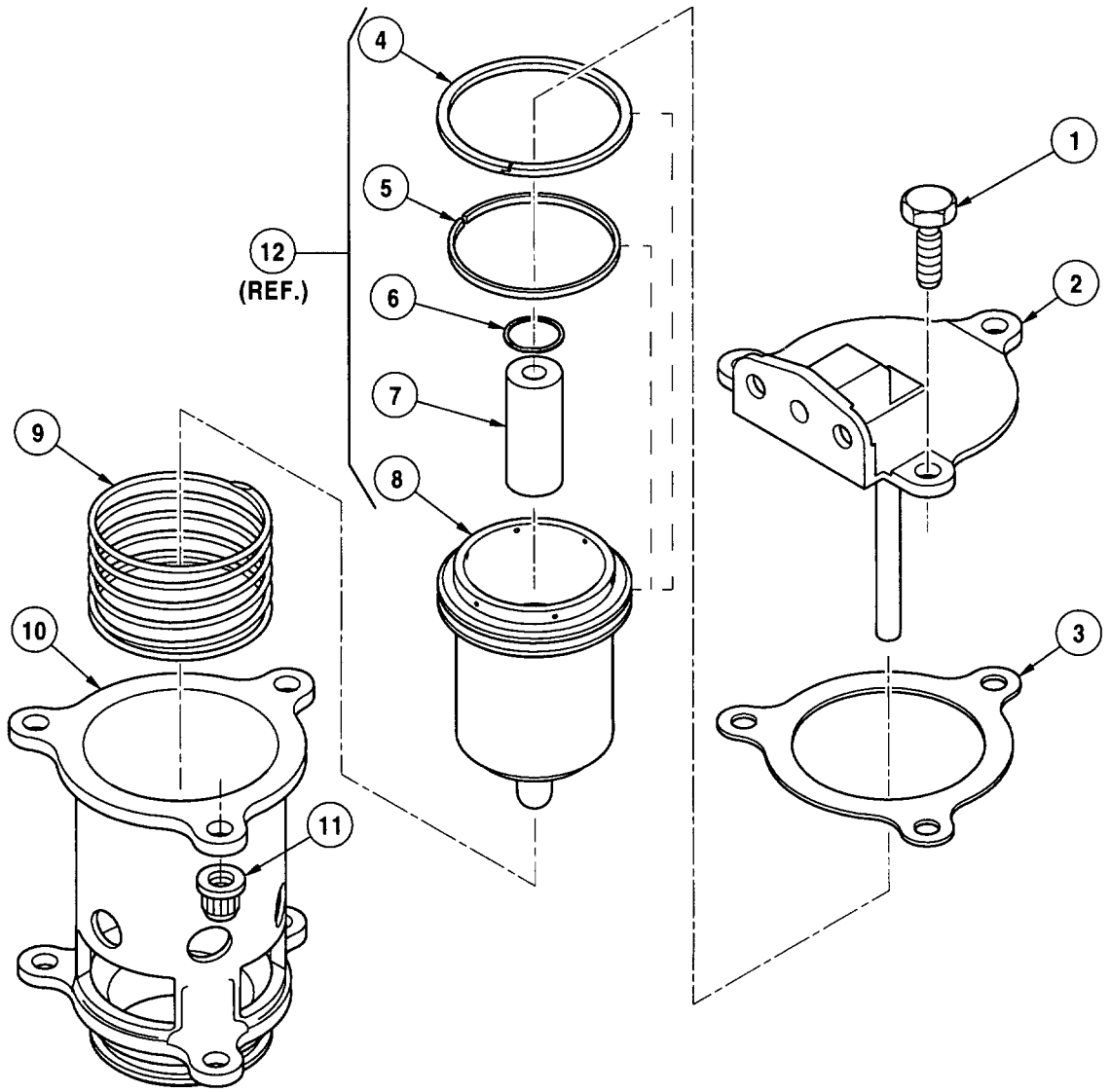
Key to Figure 203

1. Bolt (Pre-SB24186 or Post-SB24318 or Post-SB24323)
2. Compressor Bleed Valve Cover Assembly (Pre-SB24186 or Post-SB24318 or Post-SB24323)
3. Gasket (Pre-SB24186 or Post-SB24318 or Post-SB24323)
4. Plastic Seal Ring (Pre-SB24283 and Pre-SB24312)
5. Metal Seal Ring (Pre-SB24283 and Pre-SB24312)
6. Retaining Ring
7. Sleeve Spacer
8. Compressor Bleed Valve Piston
9. Self-locking Nut (Pre-SB24186 or Post-SB24318 or Post-SB24323)
10. P2.5 Compressor Bleed Valve Housing Assembly
11. Compressor Bleed Valve Piston Assembly (Ref.)
12. Helical Spring (Post-SB24186 or Pre-SB24318 or Pre-SB24323)
13. Compressor Bleed Valve Seat (Post-SB24186 or Pre-SB24318 or Pre-SB24323)
14. Screw (Post-SB24186 or Pre-SB24318 or Pre-SB24323)
15. Seal Ring (Post-SB24283 and Post-SB24312)



C34301B

Disassembly/Assembly of P2.5 Compressor Bleed Valve Assembly
Figure 203 (Sheet 2)



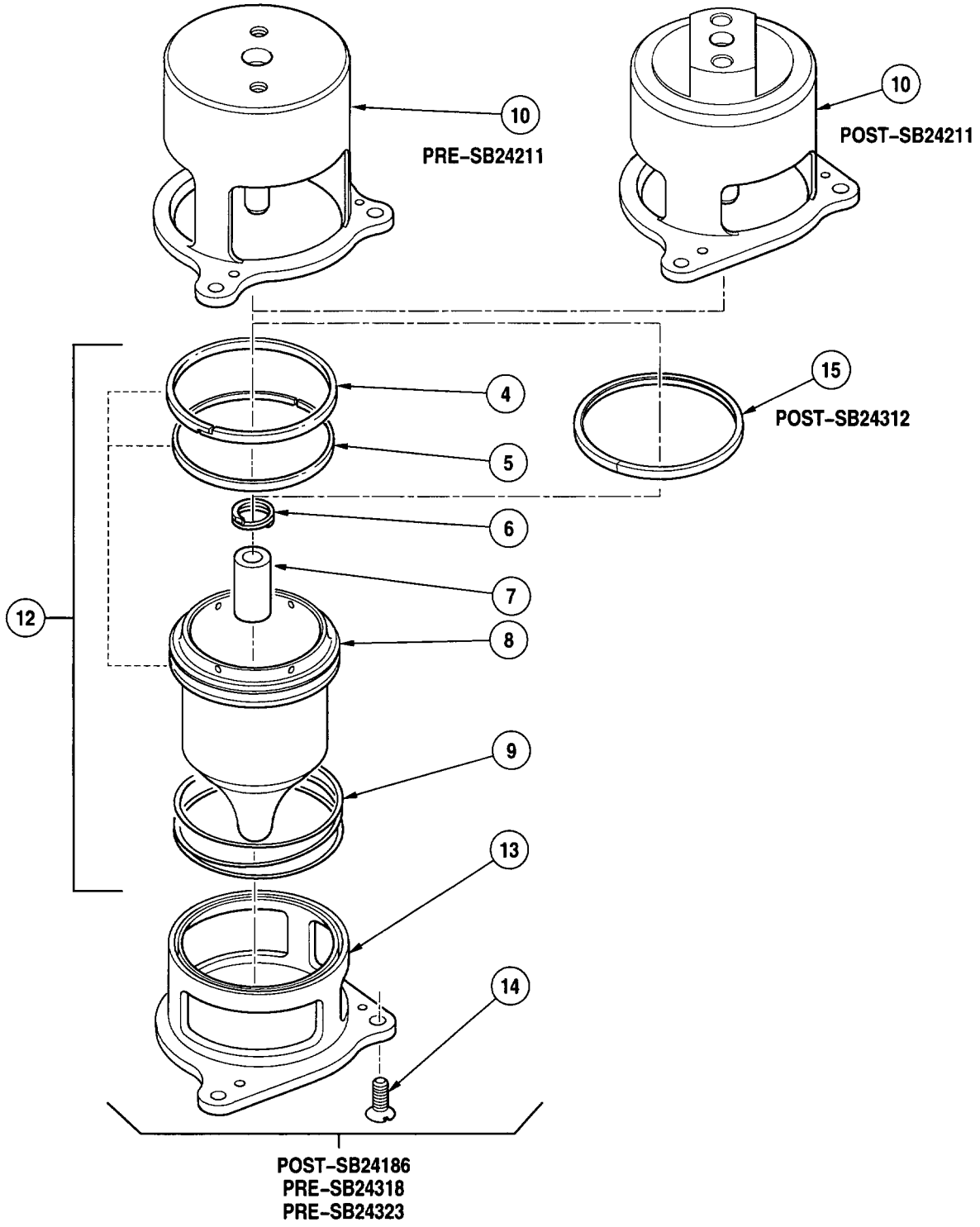
PRE-SB24186
POST-SB24318
POST-SB24323

C32831C

Disassembly/Assembly of P2.8 Compressor Bleed Valve
Figure 204 (Sheet 1 of 2)

Key to Figure 204

1. Bolt (Pre-SB24186 or Post-SB24318 or Post-SB24323)
2. Compressor Bleed Valve Cover Assembly (Pre-SB24186 or Post-SB24318 or Post-SB24323)
3. Gasket (Pre-SB24186 or Post-SB24318 or Post-SB24323)
4. Non-metallic Seal Ring (Pre-SB24312)
5. Metal Seal Ring (Pre-SB24312)
6. Retaining Ring
7. Sleeve Spacer
8. Compressor Bleed Valve Piston
9. Helical Spring
10. Compressor Bleed Valve Housing Assembly
11. Self-locking Nut
12. Compressor Bleed Valve Piston Assembly (Ref.)
13. Compressor Bleed Valve Seat (Post-SB24186 or Pre-SB24318 or Pre-SB24323)
14. Screw (Post-SB24186 or Pre-SB24318 or Pre-SB24323)
15. Seal Ring (Post-SB24312)



C34298C

Disassembly/Assembly of P2.8 Compressor Bleed Valve
Figure 204 (Sheet 2)

(5) Remove retaining ring (6) and sleeve spacer (7) from piston (8).

(6) Remove spring (9) from housing assembly (10).

B. Disassembly (Post-SB24186 or Pre-SB24318 or Pre-SB24323) (Ref. Fig. 204)

(1) Remove the three screws (14) that attach bleed valve housing assembly (10) to bleed valve seat (13).

(2) Remove the valve housing (10).

(3) Remove the bleed valve piston (12) from the valve housing.

(4) Pre-SB24312: Remove the plastic seal ring (4) and the metal seal ring (5) from piston (8).

(5) Post-SB24312: Remove the sealing ring (15) from piston (8).

(6) Remove the retaining ring (6) and sleeve spacer (7) from piston (8).

(7) Remove the spring (9) from valve seat (13).

C. Disassembly (Post-SB24323) (Ref. Fig. 204)

(1) Remove the three bolts (1) and the three self-locking nuts (11) that attach cover assembly (2).

(2) Remove the cover assembly (2) and the gasket (3). Discard the gasket.

(3) Remove the piston assembly (12) from the housing assembly (10).

(4) Remove the sealing ring (15) from the piston (8).

(5) Remove the retaining ring (6) and the sleeve spacer (7) from the piston (8).

(6) Remove the spring (9) from the housing assembly (10).

D. Examine Valve Seating (Ref. Fig. 205)

(1) Pre-SB24186 or Post-SB24318 or Post-SB24323:

(a) Put a thin film of layout dye (PWC05-041) around the bleed valve piston (8) on Surface D.

(b) Insert piston (8) into the housing assembly (10) and allow Surface D to contact Surface B.

(c) Remove the piston (8) from the housing (10) without turning it.

(d) Do an inspection of Surface B of bleed valve housing (10) for an unbroken blue line, indicating 360-degree contact with housing (10).

(e) If there is 360-degree contact between the piston (8) and the housing (10), remove all traces of layout dye and then proceed to Para. F..

(f) If there is not 360-degree contact between the piston (8) and the housing (10), lap valve and seat (Ref. Para. E.).

(2) Post-SB24186 or Pre-SB24318 or Pre-SB24323:

(a) Install the sleeve spacer (7) into compressor bleed valve piston (8), chamfered edge first. Attach with retaining ring (6).

(b) Pre-SB24312:

CAUTION: DO NOT OVER EXTEND METAL SEAL RING (5) DURING INSTALLATION. GAP MUST BE 0.545 - 0.670 INCH WHEN INSTALLED.

1 Install the metal seal ring (5) into groove of bleed valve piston (8).

2 Install the plastic seal ring (4) with split joint positioned 180 ± 20 degrees from gap of the metal seal ring (5).

(c) Post-SB24312: Install the seal ring (15) into groove of bleed valve piston (8).

(d) Attach bleed valve housing assembly (10) to holding fixture (PWC60158) with two bolts. Connect air supply to fixture.

(e) Put a thin film of mechanics blue around the piston (8) on Surface E.

(f) Install the piston (8) into bleed valve housing assembly (10).

(g) Attach the bleed valve seat (13) to housing assembly with three screws (14). Torque screws to 10 to 11.5 lb.in. (1.1-1.3 Nm).

(h) Turn on air supply with sufficient pressure to mate seating surfaces.

(i) Turn off air supply. Remove the three screws (14) and compressor bleed valve seat (13).

NOTE: Do not allow bleed valve seat to turn when removing from bleed valve housing.

(j) Do an inspection of Surface F of bleed valve seat (13) for an unbroken blue line indicating 360-degree contact with piston (8).

(k) If there is 360-degree contact between piston and housing, clean both parts to remove all traces of mechanics blue. Proceed to Para. F..

(l) If there is not 360-degree contact between piston (8) and bleed valve seat (13), lap valve and seat (Ref. Para. E.).

E. Lap Valve and Seat (Ref. Fig. 205)

(1) Pre-SB24186 or Post-SB24318 or Post-SB24323:

(a) Apply small amount of lapping compound to Surface D of piston (8).

(b) Install the piston (8) into housing assembly (10) and lap sealing surfaces until 360-degree contact is achieved.

(c) Remove the piston from housing assembly.

(d) Clean the piston and the housing assembly with petroleum solvent. Make sure all traces of lapping compound are removed.

(e) Repeat Para. D..

(2) Post-SB24186 or Pre-SB24318 or Pre-SB24323:

CAUTION: DO NOT ALLOW LAPPING COMPOUND TO CONTACT SEALING RINGS.

(a) Apply a thin, even coat of lapping compound to Surface F of bleed valve seat (13).

(b) Install the piston (8) into bleed valve housing.

(c) Install bleed valve seat (13) to bleed valve housing with three screws (14). Torque screws to 10 to 11.5 lb.in. (1.1-1.3 Nm).

(d) Turn on air supply with sufficient pressure to mate seating surfaces.

(e) Rotate piston against seat Surface F with lapping tool (PWC60149) until 360-degree contact is achieved.

(f) Turn off air supply. Remove housing assembly from holding fixture.

(g) Remove the three screws (14) and bleed valve seat (13). Remove the piston (8) from housing.

(h) Clean the piston and the housing assembly with petroleum solvent. Make sure all traces of lapping compound are removed.

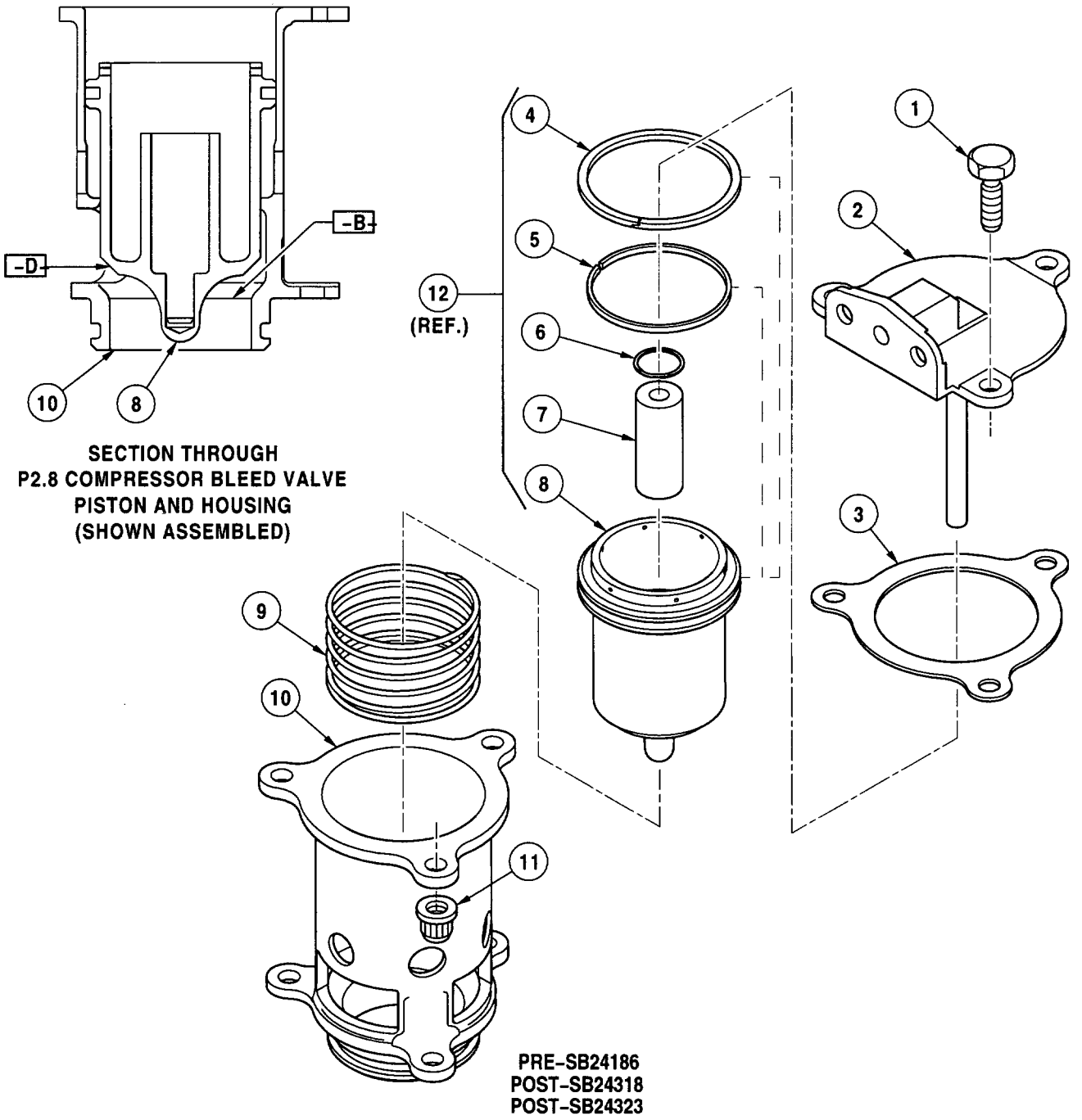
(i) Repeat Para. D..

F. Assembly (Pre-SB24186 or Post-SB24318 or Post-SB24323) (Ref. Fig. 205)

(1) Install the sleeve spacer (7), chamfered end down, in bleed valve piston (8). Attach with retaining ring (6).

(2) Install the metal seal ring (5) in bleed valve piston (8).

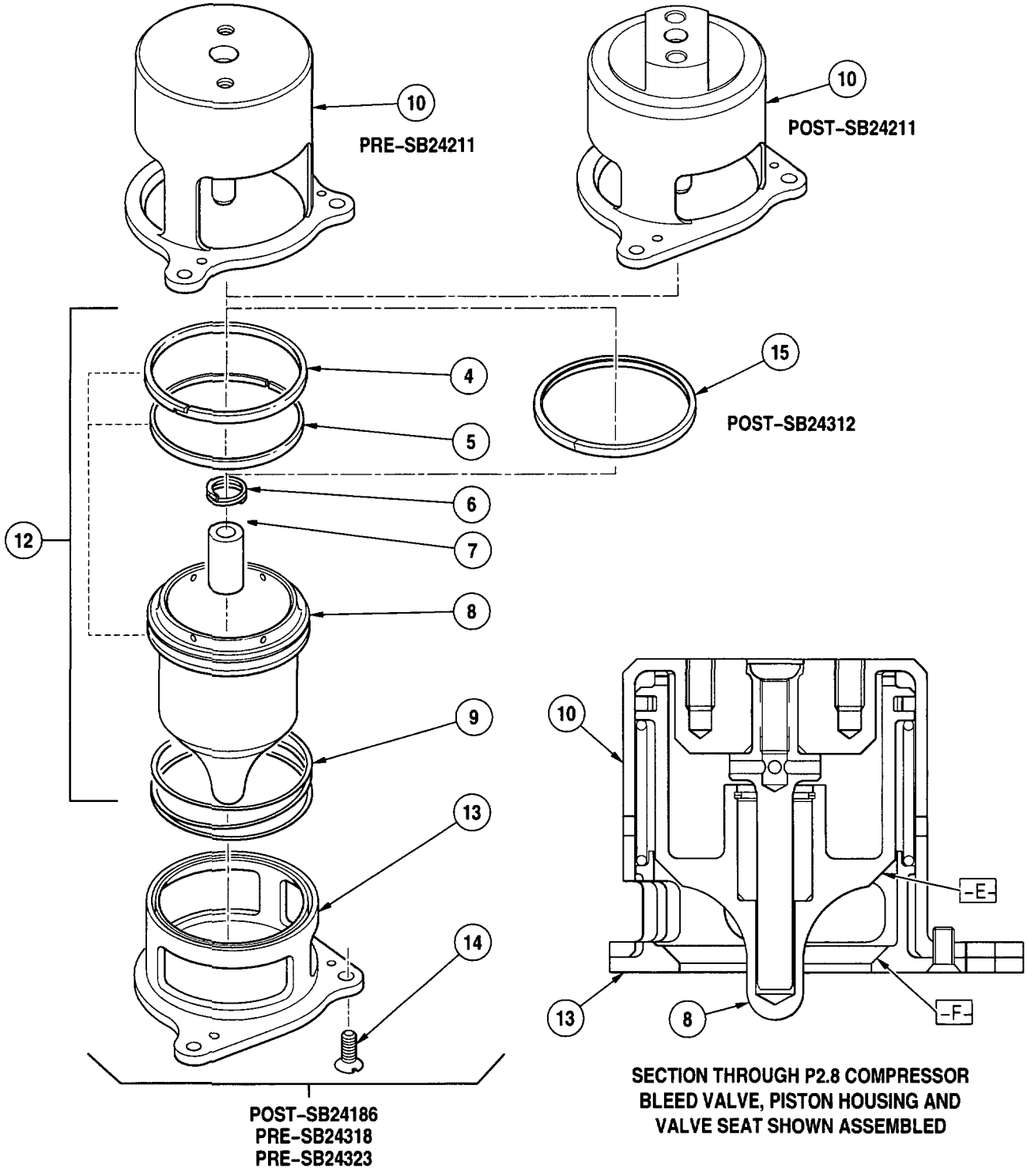
(3) Install the non-metallic seal ring (4) in bleed valve piston (8). Put gap 180 ± 20 degrees from gap in metal seal ring (5).



Disassembly/Assembly of P2.8 Compressor Bleed Valve
Figure 205 (Sheet 1 of 2)

Key to Figure 205

1. Bolt (Pre-SB24186 or Post-SB24318 or Post-SB24323)
2. Compressor Bleed Valve Cover Assembly (Pre-SB24186 or Post-SB24318 or Post-SB24323)
3. Gasket (Pre-SB24186 or Post-SB24318 or Post-SB24323)
4. Non-metallic Seal Ring (Pre-SB24312)
5. Metal Seal Ring (Pre-SB24312)
6. Retaining Ring
7. Sleeve Spacer
8. Compressor Bleed Valve Piston
9. Helical Compression Spring
10. Compressor Bleed Valve Housing Assembly
11. Self-locking Nut
12. Compressor Bleed Valve Piston Assembly (Ref.)
13. Compressor Bleed Valve Seat (Post-SB24186 or Pre-SB24318 or Pre-SB24323)
14. Screw (Post-SB24186 or Pre-SB24318 or Pre-SB24323)
15. Seal Ring (Post-SB24312)



C34302C

Disassembly/Assembly of P2.8 Compressor Bleed Valve
Figure 205 (Sheet 2)

(4) Install the compression spring (9) in bleed valve housing (10).

(5) Install the bleed valve piston assembly (12) in bleed valve housing (10).

(6) Install one new gasket (3) and bleed valve cover assembly (2) on bleed valve housing (10). Attach with three bolts (1) and three self-locking nuts (11). Torque nuts to 36 to 40 lb.in. (4.1-4.6 Nm).

(7) Put assembly in a clean sealable container and put on bench until needed for testing.

G. Assembly (Post-SB24186 or Pre-SB24318 or Pre-SB24323) (Ref. Fig. 205)

(1) Make sure all traces of mechanics blue, or lapping compound have been removed prior to assembly of bleed valve.

(2) Install piston (8) into bleed valve housing (10).

CAUTION: MAKE SURE HELICAL SPRING IS ASSEMBLED ON THE CORRECT SIDE OF THE PISTON.

(3) Install helical spring (9) into groove of piston (8).

(4) Install bleed valve seat (13). Apply Molykote G to threads of screws (14) and attach bleed valve seat to bleed valve housing (10). Torque screws to 10 to 11.5 lb.in. (1.1-1.3 Nm).

H. Assembly (Post-SB24323) (Ref. Fig. 205)

(1) Install the sleeve spacer (7), chamfered end down, in bleed valve piston (8). Attach using retaining ring (6).

(2) Install the seal ring (15) in compressor bleed valve piston (8).

(3) Install the compression spring (9) in bleed valve housing (10).

(4) Install the bleed valve piston assembly (12) in bleed valve housing (10).

(5) Install one new gasket (3) and bleed valve cover assembly (2) on bleed valve housing (10). Attach using three bolts (1) and three self-locking nuts (11). Torque nuts to 36 to 40 lb.in. (4.1-4.6 Nm).

(6) Put assembly in a clean sealable container and put on bench until needed for testing.

9. Cleaning

A. Compressor Bleed Valves

(1) Wash parts in clean alcohol (PWC11-014) or acetone (PWC11-012). If necessary, use nylon bristle brush to remove contaminants.

(2) Dry parts with clean, dry, filtered compressed air blast, or allow parts to stand and air dry.

10. Inspection/Check

A. Compressor Bleed Valve Housing (Ref. Fig. 206)

(1) Check valve seat for wear or damage. Damaged valve seat can be lapped to achieve 360 degree contact with compressor bleed valve piston (Part No. 31B2902-01).

(2) Check Dia. D for burnishing. Light surface burnish is acceptable.

(3) Check seal groove for nicks, burrs or raised metal. Stone to remove raised metal or sharp edges.

(4) Check all other machined surfaces for:

(a) Raised metal and sharp edges. Stone to remove.

(b) Local surface damage. Damage is acceptable to 0.005 inch (0.127 mm) deep and not acceptable beyond 0.008 inch (0.203 mm) deep. Damage from 0.005 to 0.008 inch (0.127 to 0.203 mm) deep can be blended to a maximum depth of 0.010 inch (0.254 mm).

(5) Dimensional Checks:

(a) Dimensionally check housing (Fits and Clearances REF. NOS. 1205, 1288, 1289, 1290).

B. Compressor Bleed Valve Cover Assembly (Ref. Fig. 207)

(1) Check guide pin shaft for:

(a) Scores or scratches. Polish using crocus cloth to remove raised metal.

(b) Security. Reject if loose.

(c) Squareness to cover. Reject if beyond limits specified.

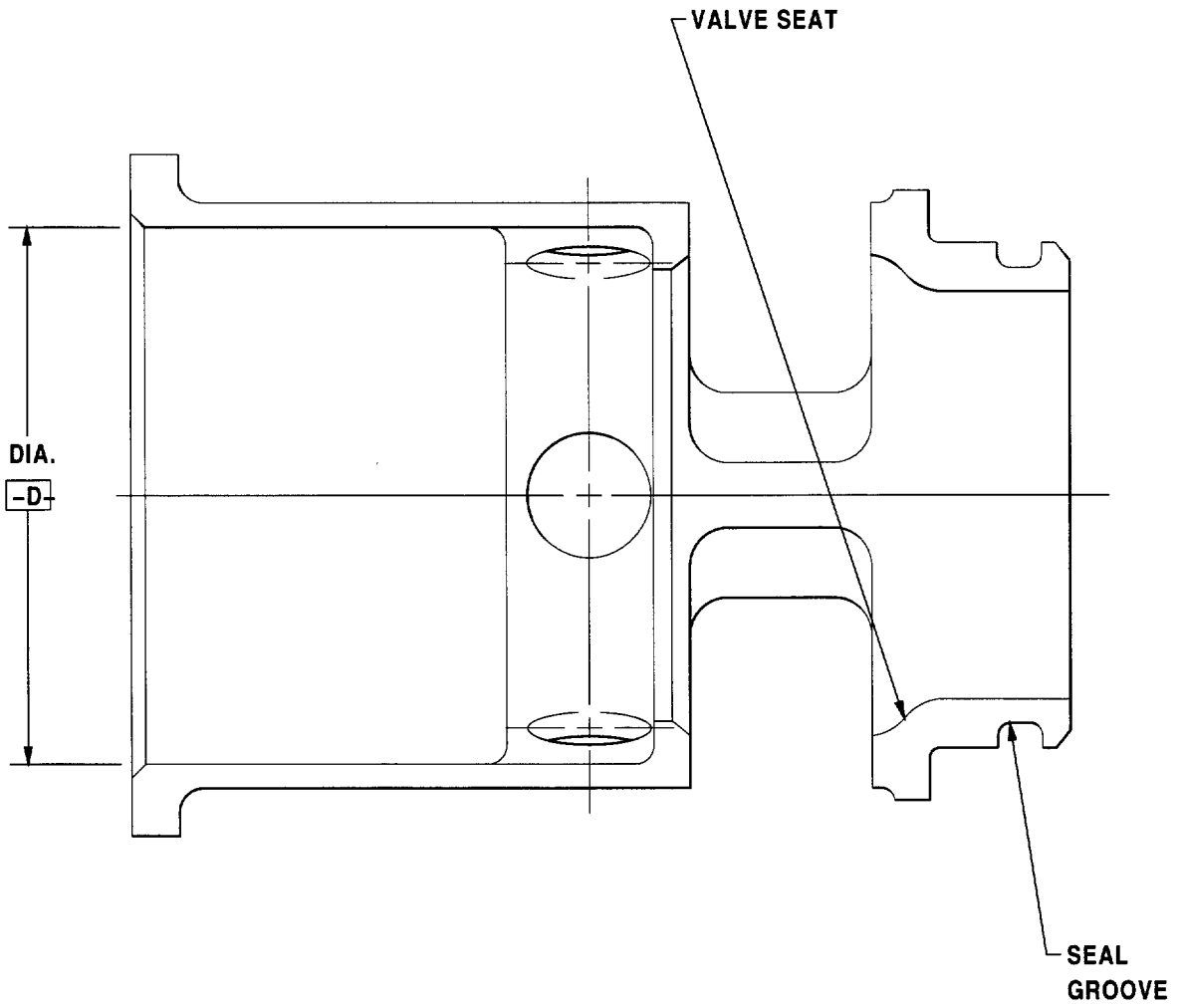
(d) Check all other machined surfaces for:

1 Raised metal and sharp edges. Stone to remove.

2 Local surface damage. Damage is acceptable to 0.005 inch (0.127 mm) deep and not acceptable beyond 0.008 inch (0.203 mm) deep. Damage from 0.005 to 0.008 inch (0.127 to 0.203 mm) deep can be blended to a maximum depth of 0.010 inch (0.254 mm).

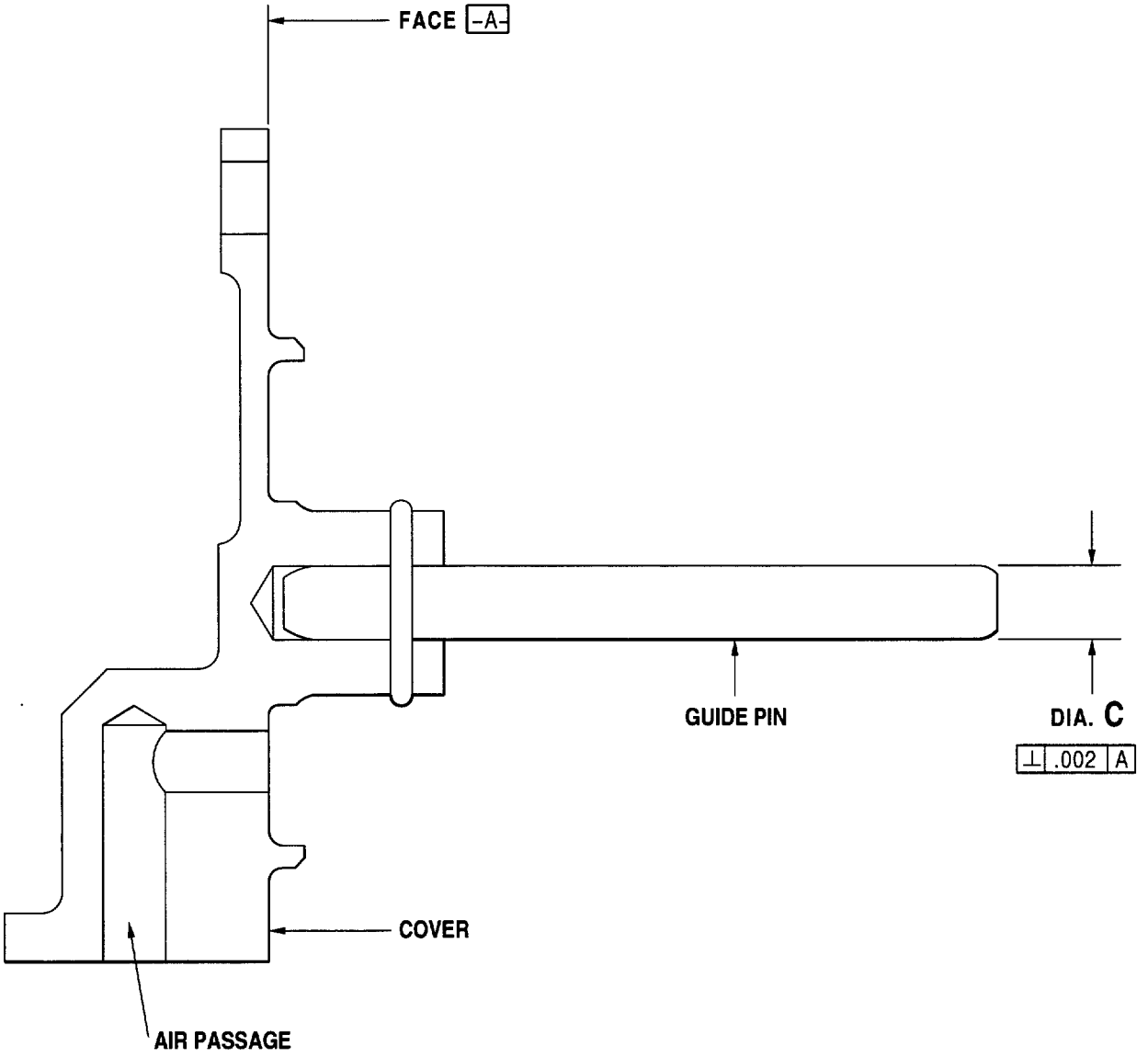
(e) Check that air passage is clear and unobstructed. Clean if necessary.

(2) Dimensional Checks



C31628

Compressor Bleed Valve Housing
Figure 206



C21476

Compressor Bleed Valve Cover Assembly
Figure 207

(a) Dia. C (guide pin) for wear. Reject if diameter less than 0.234 inch (5.94 mm) (Ref. Fits and Clearances REF. NO. 1293).

(b) Remainder of cover assembly (Fits and Clearances REF. NO. 1288).

C. Compressor Bleed Valve Piston (Ref. Fig. 208)

(1) Check valve seat for:

(a) Wear or damage. Damaged valve seat can be lapped to achieve 360 degree contact with compressor bleed valve housing (Part No. 31B2905-01).

(b) Sealing ring and retaining ring grooves for nicks, burrs or raised metal. Stone to remove raised metal and sharp edges.

(2) Check all other surfaces for:

(a) Raised metal and sharp edges. Stone to remove.

(b) Local surface damage. Damage is acceptable to 0.002 inch (0.051 mm) deep and not acceptable beyond 0.005 inch (0.127 mm) deep. Damage from 0.002 to 0.005 inch (0.051 to 0.127 mm) deep can be blended to a maximum depth of 0.005 inch (0.127 mm).

(3) Dimensional Checks:

(a) Dim. a (sealing ring groove) for wear. Reject piston if dimension in excess of 0.0995 inch (2.527 mm).

(b) Remainder of piston (Fits and Clearances REF. NOS. 1289, 1290, 1292, 1293).

D. Sleeve Spacer (Ref. Fig. 209)

(1) Check for damage. Reject if any damage evident.

(2) Dimensionally check:

(a) Dia. A for wear. Reject sleeve if diameter in excess of 0.2395 inch (6.083 mm) (Ref. Fits and Clearances REF. NO. 1293).

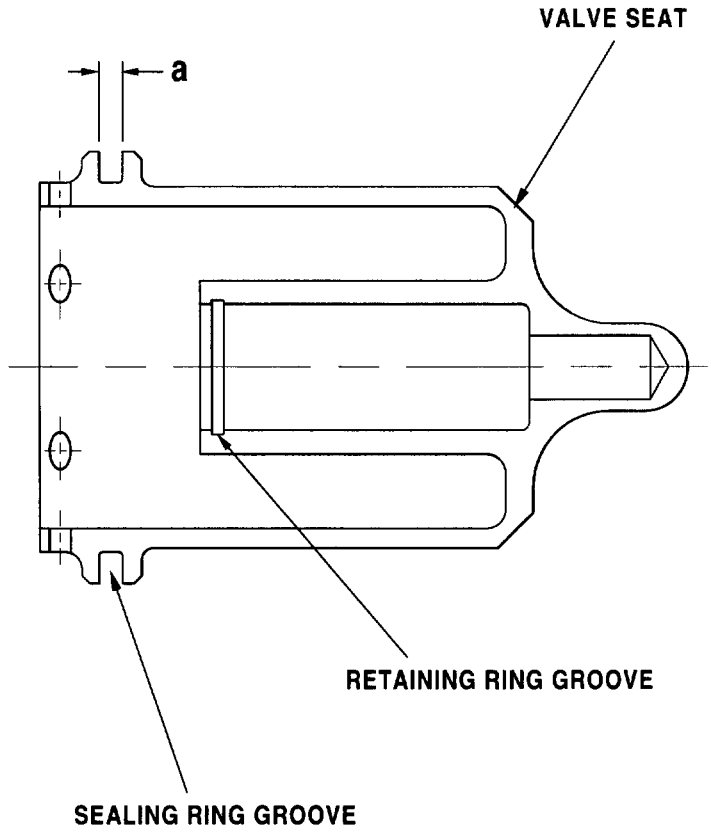
(b) Dia. B for wear. Reject sleeve if diameter less than 0.492 inch (12.497 mm) (Ref. Fits and Clearances REF. NO. 1292).

E. Flange Adapter (Ref. Fig. 210)

(1) Check Dia. B for nicks, burrs and raised material. Stone to remove raised metal and sharp edges.

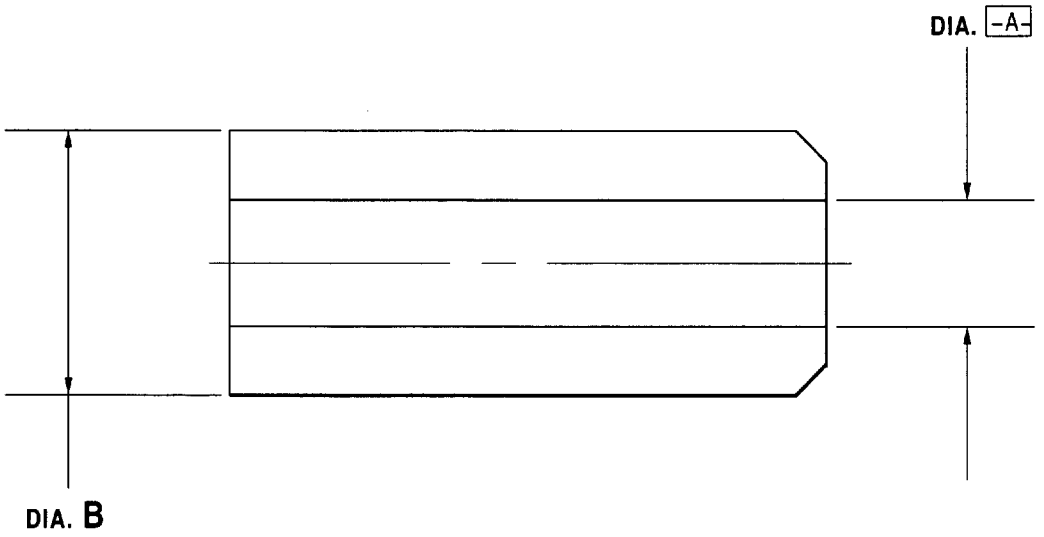
(2) Check surface f for:

(a) Wear or damage. Damaged surface F can be lapped to achieve 360 degree contact.



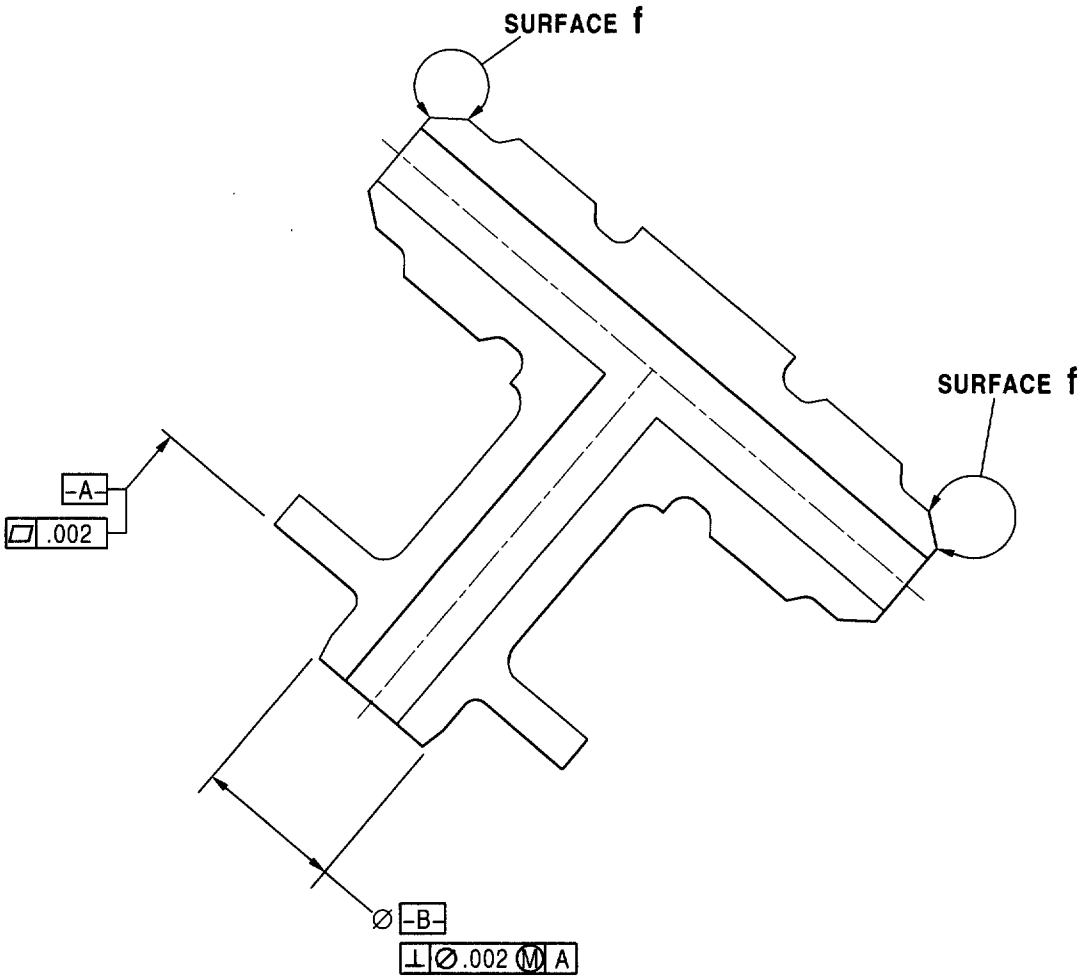
C31629A

Compressor Bleed Valve Piston
Figure 208



C21477

Sleeve Spacer
Figure 209



C27979

Flange Adapter
Figure 210

(3) Check threads for nicks, burrs or raised metal. Stone to remove raised metal and sharp edges.

(4) Clear and unobstructed passages. Pressure flush to remove any trapped debris.

(5) Check all other surfaces for corrosion. Corrosion is acceptable to a maximum of 0.008 inch (0.203 mm) deep and can be blended to a maximum depth of 0.012 inch (0.305 mm).

F. Metal Seal Ring (Ref. Fig. 211)

(1) Check faces for nicks, burrs or raised metal. Stone to remove raised metal and sharp edges.

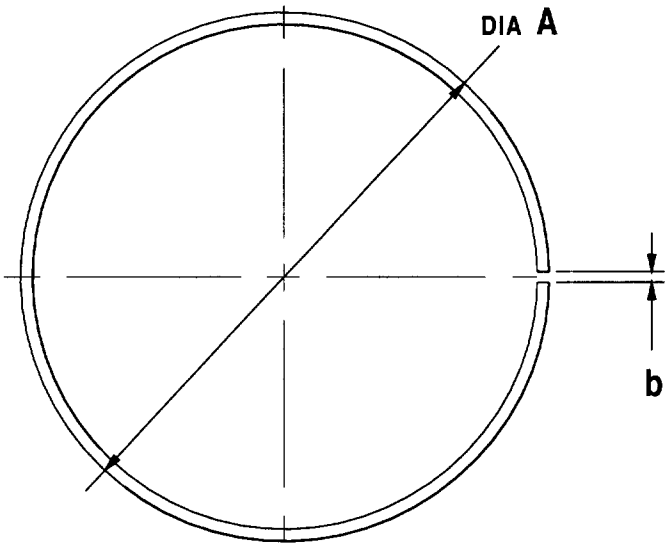
(2) Check Dia. A for:

(a) Raised metal or sharp edges. Stone to remove.

(b) Local surface damage, wear or fretting. Acceptable to a maximum depth of 0.001 inch (0.025 mm).

(3) Dimensional Checks:

(a) Check Dim. b, free state gap. Reject seal ring if gap not within 0.375 to 0.500 inch (9.525 to 12.7 mm).



C31630A

Metal Seal Ring
Figure 211

11. Fits, Clearances and Torque Loadings

TABLE 201, Fits and Clearances

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1205	Pre-SB24186 Post-SB24318 Post-SB24323 Hsg - Comp Bleed Valve	1.565 (39.751)	1.567 (39.802)	0.001 (0.025)	0.006 (0.152)	
	Elbow - Tube To Boss	1.568 (39.827)	1.571 (39.903)			
1205	Post-SB24186 Not Applicable					
1229	Pre-SB24186 Post-SB24318 Post-SB24323 Hsg - Comp Bleed Valve	2.0688 (52.548)	2.0695 (52.565)	0.0005 (0.013)	0.003 (0.076)	
	Case - HP Comp, Assy Of	2.0700 (52.578)	2.0718 (52.624)			
1229	Post-SB24186 Pre-SB24318 Pre-SB24323 Hsg - Comp Bleed Valve	2.0692 (52.555)	2.0696 (52.568)	0.0004 (0.010)	0.0027 (0.069)	
	Case - HP Comp, Assy Of	2.0700 (52.578)	2.0718 (52.624)			
1230	Pre-SB24186 Post-SB24318 Post-SB24323 Cover - Comp Bleed Valve	2.403 (61.036)	2.404 (61.062)	0.000 (0.000)	0.003 (0.076)	
	Hsg - Comp Bleed Valve	2.404 (61.062)	2.406 (61.112)			

TABLE 201, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1230	Post-SB24186 Not Applicable					
1231	Pre-SB24186 Post-SB24318 Post-SB24323 Piston - Comp Bleed Valve	2.400 (60.960)	2.402 (61.01)	0.002 (0.051)	0.006 (0.152)	
	Hsg - Comp Bleed Valve	2.404 (61.062)	2.406 (61.112)			
1231	Post-SB24186 Pre-SB24318 Pre-SB24323 Piston - Comp Bleed Valve	2.387 (60.630)	2.389 (60.681)	0.015 (0.381)	0.019 (0.482)	
	Hsg - Comp Bleed Valve	2.404 (61.062)	2.406 (61.112)			
1232	Pre-SB24186 Post-SB24318 Post-SB24323 Piston - Comp Bleed Valve	2.063 (52.400)	2.065 (52.451)	0.015 (0.381)	0.020 (0.508)	
	Hsg - Comp Bleed Valve	2.080 (52.832)	2.083 (52.908)			
1232	Post-SB24186 Pre-SB24318 Pre-SB24323 Piston - Comp Bleed Valve	2.053 (52.146)	2.057 (52.248)	0.036 (0.914)	0.042 (1.067)	
	Hsg - Comp Bleed Valve	2.093 (53.162)	2.095 (53.213)			

TABLE 201, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1233	Pre-SB24186 Post-SB24318 Post-SB24323 Shft - Guide, Bleed Valve Piston	0.2350 (5.969)	0.2355 (5.982)	0.000 (0.000)	0.0015T (0.038T)	
	Cover - Comp Bleed Valve	0.234 (5.944)	0.235 (5.969)			
1233	Post-SB24186 Pre-SB24318 Pre-SB24323 Shft - Guide, Bleed Valve Piston	0.3012 (7.650)	0.3018 (7.665)	0.0006T (0.015T)	0.0018T (0.045T)	
	Cover - Comp Bleed Valve	0.3000 (7.620)	0.3006 (7.635)			
1234	Spacer - Sleeve	0.4930 (12.522)	0.4955 (12.586)	0.0035 (0.089)	0.008 (0.203)	
	Piston - Comp Bleed Valve	0.499 (12.675)	0.501 (12.725)			
1235	Shaft - Guide, Bleed Valve Piston	0.2350 (5.969)	0.2355 (5.982)	0.001 (0.025)	0.0035 (0.089)	
	Spacer - Sleeve	0.2365 (6.007)	0.2385 (6.058)			
1288	Pre-SB24186 Post-SB24318 Post-SB24323 Cover - Comp Bleed Valve	1.658 (42.113)	1.660 (42.164)	0.000 (0.000)	0.0026 (0.066)	
	Hsg - Comp Bleed Valve	1.6600 (42.164)	1.6606 (42.179)			
1288	Post-SB24186 Not Applicable					

TABLE 201, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1289	Pre-SB24186 Post-SB24318 Post-SB24323 Piston - Comp Bleed Valve	1.6519 (41.958)	1.6525 (41.973)	0.0075 (0.191)	0.0087 (0.221)	
	Hsg - Comp Bleed Valve	1.6600 (42.164)	1.6606 (42.179)			
1289	Post-SB24186 Pre-SB24318 Pre-SB24323 Piston - Comp Bleed Valve	1.795 (45.593)	1.805 (45.847)	0.033 (0.838)	0.0466 (1.183)	
	Hsg - Comp Bleed Valve	1.838 (46.685)	1.8416 (46.776)			
1290	Pre-SB24186 Post-SB24318 Post-SB24323 Piston - Comp Bleed Valve	1.373 (34.874)	1.375 (34.925)	0.015 (0.381)	0.020 (0.508)	
	Hsg - Comp Bleed Valve	1.390 (35.306)	1.393 (35.382)			
1290	Post-SB24186 Pre-SB24318 Pre-SB24323 Piston - Comp Bleed Valve	1.550 (39.370)	1.560 (39.624)	0.035 (0.889)	0.055 (1.397)	
	Hsg - Comp Bleed Valve	1.595 (40.5131)	1.605 (40.767)			
1291	Pre-SB24186 Post-SB24318 Post-SB24323 Shaft - Guide Pin, Bleed Valve Piston	0.2350 (5.969)	0.2355 (5.982)	0.0000 (0.000)	0.0015T (0.038T)	
	Cover - Comp Bleed Valve	0.234 (5.944)	0.235 (5.969)			

TABLE 201, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Replace
1291	Post-SB24186 Pre-SB24318 Pre-SB24323 Shaft - Guide Pin, Bleed Valve Piston	0.3012 (7.650)	0.3018 (7.665)	0.0006T (0.015T)	0.0018T (0.046T)	
	Cover - Comp Bleed Valve	0.3000 (7.620)	0.3006 (7.635)			
1292	Pre-SB24186 Post-SB24318 Post-SB24323 Spacer - Sleeve	0.4930 (12.522)	0.4955 (12.586)	0.0035 0.089	0.008 0.203	
	Piston - Comp Bleed Valve	0.499 (12.675)	0.501 (12.725)			
1292	Post-SB24186 Pre-SB24318 Pre-SB24323 Spacer - Sleeve	0.4964 (12.608)	0.4980 (12.649)	0.002 0.050	0.0076 0.190	
	Piston - Comp Bleed Valve	0.500 (12.700)	0.504 (12.801)			
1293	Pre-SB24186 Post-SB24318 Post-SB24323 Shaft - Guide Pin, Bleed Valve Piston	0.2350 (5.969)	0.2355 (5.982)	0.001 (0.025)	0.0035 (0.089)	
	Spacer - Sleeve	0.2365 (6.007)	0.2385 (6.058)			
1293	Post-SB24186 Pre-SB24318 Pre-SB24323 Shaft - Guide Pin, Bleed Valve Piston	0.2337 (5.935)	0.2342 (5.948)	0.0008 (0.020)	0.002 (0.050)	
	Spacer - Sleeve	0.2350 (5.969)	0.2357 (5.986)			

TABLE 202, Torque and Stretch

REF. NO.	Name	Limits Min.	Limits Max.
	Not Applicable		

TABLE 203, Spring Pressures

REF. NO.	Name	Limits Min.	Limits Max.
1753	Helical Compression Spring		
	At length0.900 (22.860)	0.58 (0.26)	0.64 (0.29)
	At length2.000 (50.800)	0.36 (0.16)	0.42 (0.19)
1755	Helical Compression Spring Post-SB24283		
	At length1.042 (24.441)	0.608 (0.280)	0.713 (0.320)

TABLE 204, Special Assembly Procedures

REF. NO.	Name	Limits Min.	Limits Max.
1809	Seal Rings Assembly (Pre-SB24312)		
	(1) Assemble metallic ring so that split joint is 180° ± 20° from split joint of non-metallic ring.		
1809	Seal Rings Assembly (Post-SB24312)		
	(1) Not Applicable		
1810	Compressor Bleed Valve Assembly		
	(1) If necessary, lap face of piston to obtain 360° contact.		

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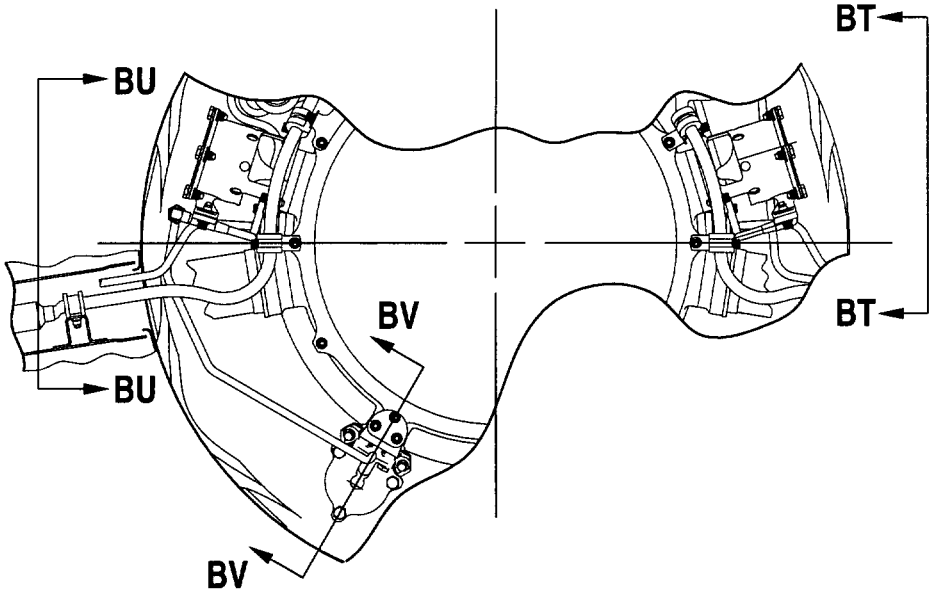

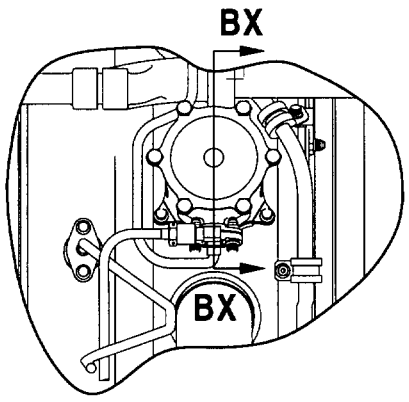

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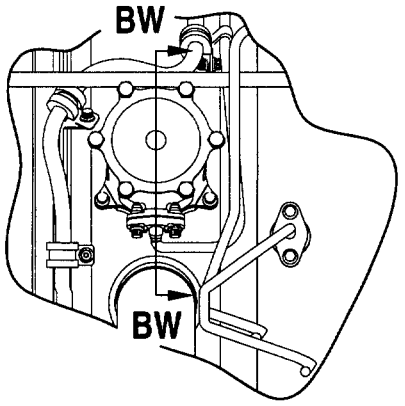

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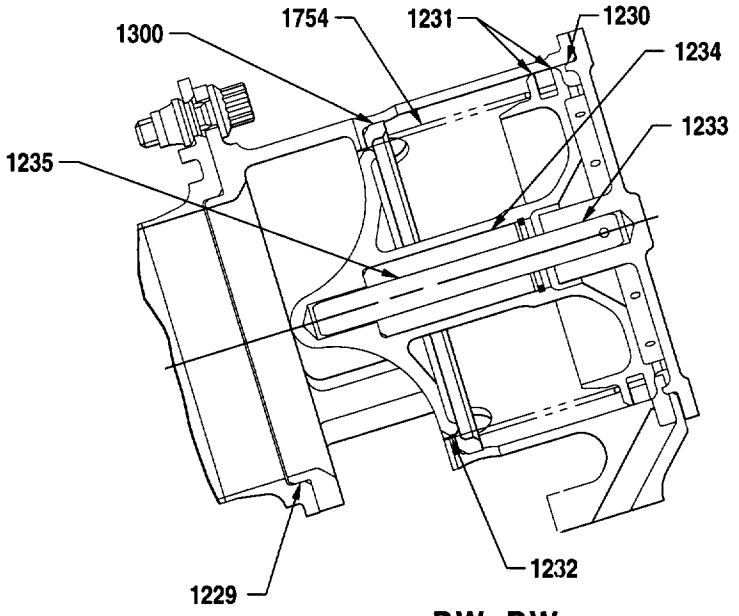
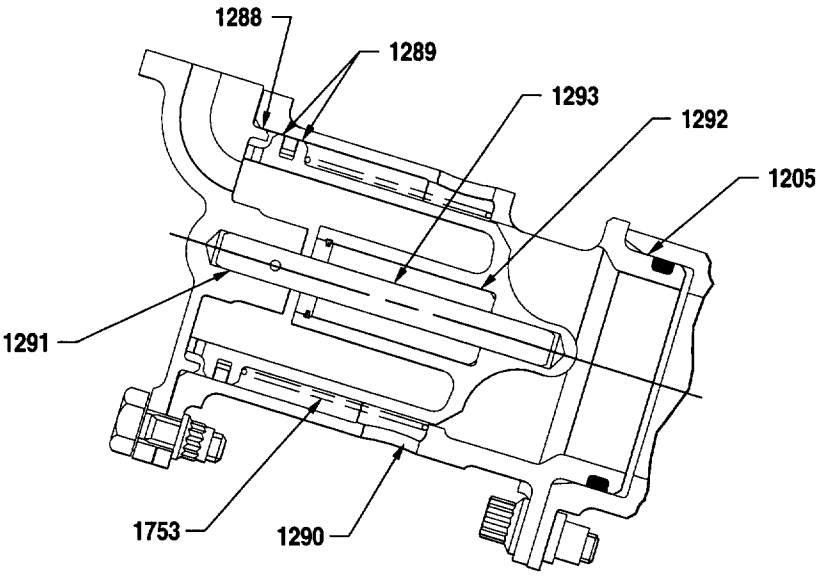
Compressor Bleed Valves - Fits and Clearances
Figure 212 (Sheet 1 of 2)



SECTION **BW-BW**
SECTION **BX-BX** SIMILAR

P2.5 COMPRESSOR
BLEED VALVE



SECTION **BV-BV**
P2.8 COMPRESSOR
BLEED VALVE

C34276

Compressor Bleed Valves - Fits and Clearances
Figure 212 (Sheet 2)

BOV SOLENOID VALVE - MAINTENANCE PRACTICES

1. General

   A. Use engine oil to lubricate preformed packings, threads and mating surfaces, unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after sub-assembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC05-089	Lockwire or Safetywire, Nickel Alloy (CRES)

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Compressor Bleed Solenoid Valve

   A. Removal (Ref. Fig. 201)

      (1) Select maintenance test discrete ON before solenoid valve removal (Ref. Aircraft Maintenance Manual).

      (2) Remove outer bypass duct, upper half and inner bypass duct, upper right segment (Ref. 72-70-01).

      CAUTION: ENSURE AIRFRAME ELECTRICAL POWER IS OFF WHEN HANDLING ELECTRICAL CONNECTORS.

      CAUTION: ENSURE CONNECTOR PLUGS ARE FREE OF MOISTURE; IF NECESSARY, DRY USING HEAT GUN.

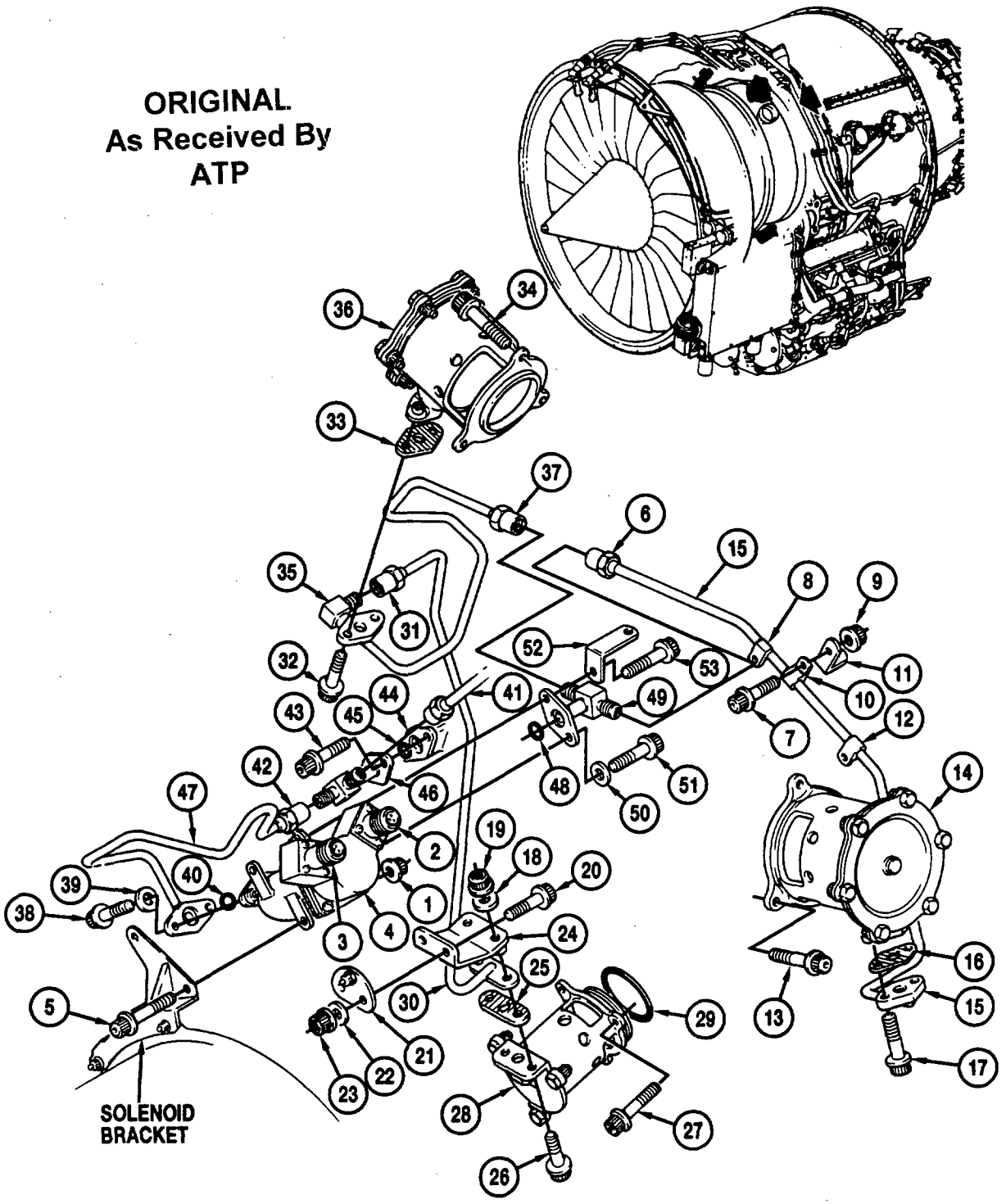
      CAUTION: DO NOT FORCE OR STRETCH HARNESS WHEN INSTALLING CONNECTORS OR SECURING LOOP CLAMPS.

      CAUTION: USE ONLY APPROVED TOOLS TO TIGHTEN HARNESS CONNECTORS. CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY BLUE COLOR BAND IS VISIBLE; RED COLOR BAND MUST NOT BE VISIBLE.

      (3) Remove wiring harness connectors from solenoid valve receptacles (2 and 3).

      (4) Disconnect loop clamp from bracket (52) (Ref. 73-20-03).

      (5) Disconnect coupling nuts (42, 6 and 37).



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Compressor Bleed Valves - Removal/Installation
Figure 201

Key to Figure 201

1. Self-locking Nut
2. P14 Receptacle
3. P13 Receptacle
4. Compressor Bleed Valve Solenoid
5. Bolt
6. Coupling Nut
7. Bolt
8. Bracket
9. Self-locking Nut
10. Loop Clamp
11. Bracket
12. Bracket
13. Bolt
14. Compressor Bleed Valve Assembly
15. Tube Assembly
16. Gasket
17. Bolt
18. Washer
19. Self-locking Nut
20. Bolt
21. Bracket
22. Washer
23. Self-locking Nut
24. Bracket Assembly
25. Gasket
26. Bolt
27. Bolt
28. Compressor Bleed Valve Assembly
29. Preformed Packing
30. P3 Air Bleed Tube Assembly
31. Coupling Nut
32. Bolt
33. Gasket
34. Bolt
35. Tube Assembly
36. Compressor Bleed Valve Assembly
37. Coupling Nut
38. Bolt
39. Washer
40. Gasket
41. Coupling Nut
42. Coupling Nut
43. Bolt
44. Flange
45. Gasket
46. Adapter
47. Tube Assembly (P3 to Solenoid Valve)
48. Gasket
49. Adapter
50. Washer
51. Bolt
52. Bracket
53. Bolt

(6) Remove two bolts (38), two washers (39), tube assembly (47) and gasket (40).

(7) Remove two self-locking nuts (1), two bolts (5) and solenoid valve (4).

(8) Remove two bolts (51 and 53), washer (50), bracket (52), adapter (49) and gasket (48).

(9) Disconnect coupling nut (41).

(10) Remove two bolts (43), adapter (46) and gasket (45).

B. Installation (Ref. Fig. 201)

CAUTION: ENSURE AIRFRAME ELECTRICAL POWER IS OFF WHEN HANDLING ELECTRICAL CONNECTORS.

CAUTION: ENSURE CONNECTOR PLUGS ARE FREE OF MOISTURE; IF NECESSARY, DRY USING HEAT GUN.

CAUTION: DO NOT FORCE OR STRETCH HARNESS WHEN INSTALLING CONNECTORS OR SECURING LOOP CLAMPS.

CAUTION: USE ONLY APPROVED TOOLS TO TIGHTEN HARNESS CONNECTORS. CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY BLUE COLOR BAND IS VISIBLE; RED COLOR BAND MUST NOT BE VISIBLE.

(1) Install new gasket (45) on adapter (46).

(2) Secure adapter (46) to flange (44) using two bolts (43). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(3) Connect coupling nut (41). Torque 90 to 100 lb.in. (10.0-11.0 Nm).

(4) Install new gasket (48) on adapter (49). Secure adapter (49) to solenoid valve (4) using bolt (53), bracket (52) and bolt (51), washer (50). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(5) Position solenoid valve (4) on solenoid mounting bracket.

CAUTION: DO NOT LUBRICATE THREADS.

(6) Secure solenoid valve (4) using two bolts (5) and two self-locking nuts. Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(7) Connect coupling nuts (6 and 37) to adapter (49). Torque 90 to 100 lb.in. (10.0-11.0 Nm) and lockwire (PWC05-089).

(8) Secure loop clamp to bracket (52) (Ref. 73-20-03)).

(9) Install new gasket (40) on tube assembly (47). Position tube assembly (47) on solenoid valve (4). Secure tube assembly (47) to solenoid valve using two washers (39) and two bolts (38). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(10) Secure coupling nut (42) to adapter (46). Torque 90 to 100 lb.in. (10.0-11.0 Nm) and lockwire (PWC05-089).

(11) Apply electrical contact enhancer to connectors (Ref. 70-00-00, CLEANING).

(12) Install wiring harness connectors P13 and P14 on solenoid valve receptacles (2 and 3).

(13) Install bypass ducts (inner and outer) (Ref. 72-70-01).

(14) Restore electrical power to appropriate system and reset EEC circuit breaker to ON.

(15) Select maintenance test discrete to OFF.

(16) Refer to Chapter 71-00-00 for checks following installation of bleed solenoid valve.

(17) Pull EEC circuit breaker to OFF.

P3 TUBES - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC05-089	Lockwire

3. Special Tools

Tool No.	Name
PWC90012	Soft Jawed Pliers

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. P3 Tubes and Transducer

   A. Remove P3 Tubes (Pre-SB24434/Post-SB24514) (Ref. Fig. 201)

      (1) Disconnect coupling nut of P3 air pressure tube (6) from P3 air pressure tube (1).

      (2) Remove bolt (12), nut (13) and loop clamp (11).

      (3) Remove bolt (14) and nut (2) and P3 tube (1).

      (4) Disconnect remaining coupling nut of P3 tube (6) at outer bypass duct.

      (5) Remove nut (9), bolt (7), loop clamp (8) and P3 tube (6). Remove loop clamp (4) from P3 tube.

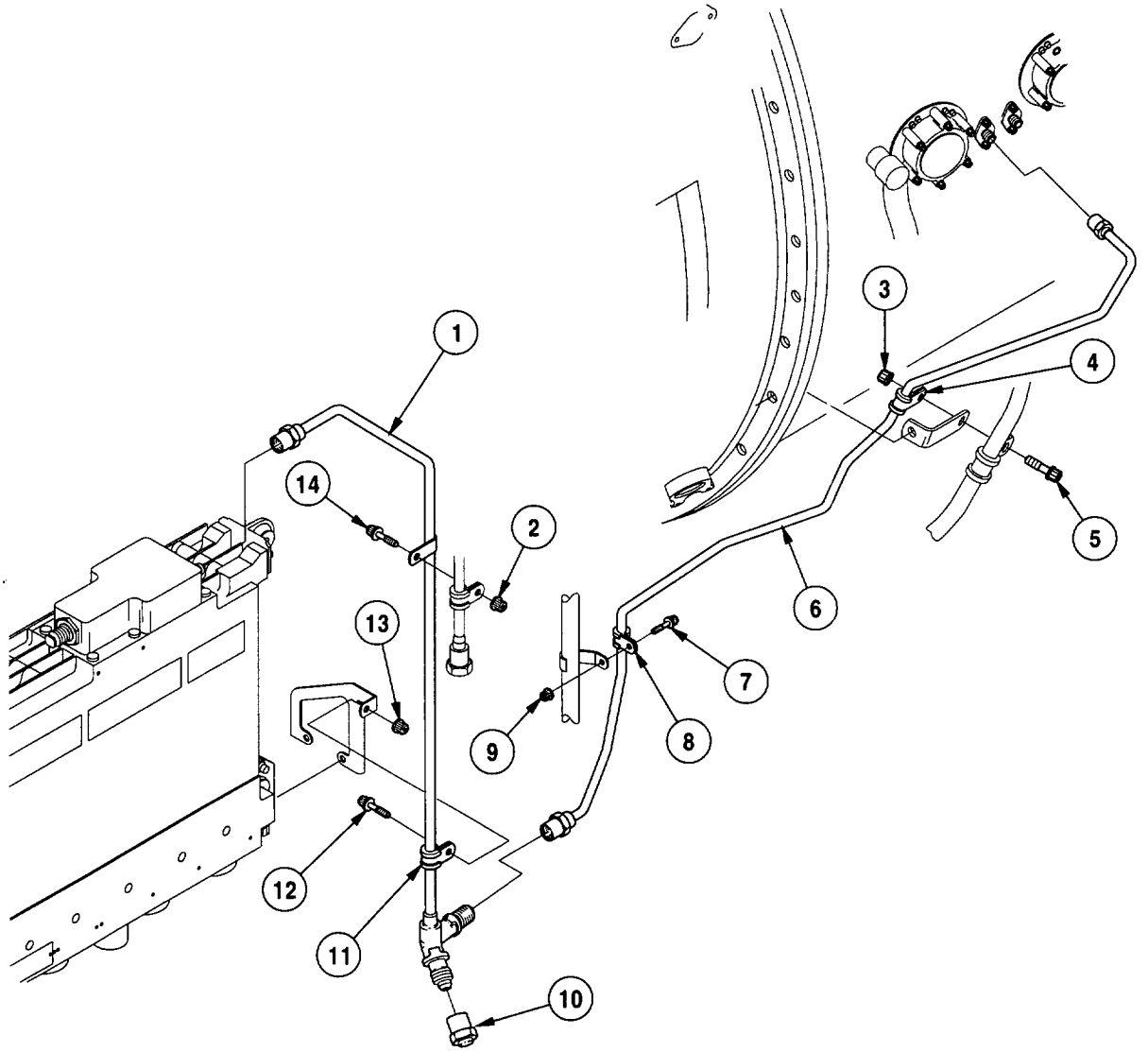
   B. Install P3 Tubes (Pre-SB24434/Post-SB24514) (Ref. Fig. 201)

      (1) Install P3 tube (1) to EEC. Tighten coupling nut with hands.

      CAUTION: DO NOT LUBRICATE THREADS OF BOLT (12).

      (2) Install loop clamp (11) on tube (1) and secure to bracket on EEC with bolt (12) and nut (13). Torque nut 27 to 30 lb.in. (4.0-4.6 Nm).

      (3) Install cap (10) on P3 tube (1). Torque cap 90 to 100 lb.in. (10.0-11.0 Nm) and lockwire (PWC05-089).



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P3 Air Pressure Tubes (Pre-SB24434/Post-SB24514) - Removal/Installation
Figure 201

Key to Figure 201

1. P3 Air Pressure Tube Assembly
2. Nut (Ref.)
3. Nut (Ref.)
4. Loop Clamp
5. Bolt (Ref.)
6. P3 Air Pressure Tube Assembly
7. Nut
8. Loop Clamp
9. Nut
10. Cap
11. Loop Clamp
12. Bolt
13. Nut
14. Bolt (Ref.)

(4) Torque coupling nut of tube (1) at EEC 90 to 100 lb.in. (10.0-11.0 Nm) and lockwire (PWC05-089).

(5) Install P3 tube assembly (6) to fitting on bypass duct. Tighten coupling nut with fingers.

(6) Install P3 tube (6) coupling nut to the middle fitting on the other P3 tube (1). Tighten coupling nut with hands.

(7) Install loop clamps (4 and 8) and secure to brackets with bolts (5 and 7) and nuts (3 and 9). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm).

(8) Torque P3 tube coupling nut at bypass duct 270 to 300 lb.in. (30.5-34.0 Nm) and lockwire (PWC05-089).

(9) Install bolt (14) and nut (2). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(10) Torque P3 tube (6) coupling nut at P3 tube (1) 90 to 100 lb.in. (10.0-11.0 Nm) and lockwire (PWC05-089).

C. Remove P3 Tubes and Transducer (Post-SB24434/Pre-SB24514) (Ref. Fig. 202)

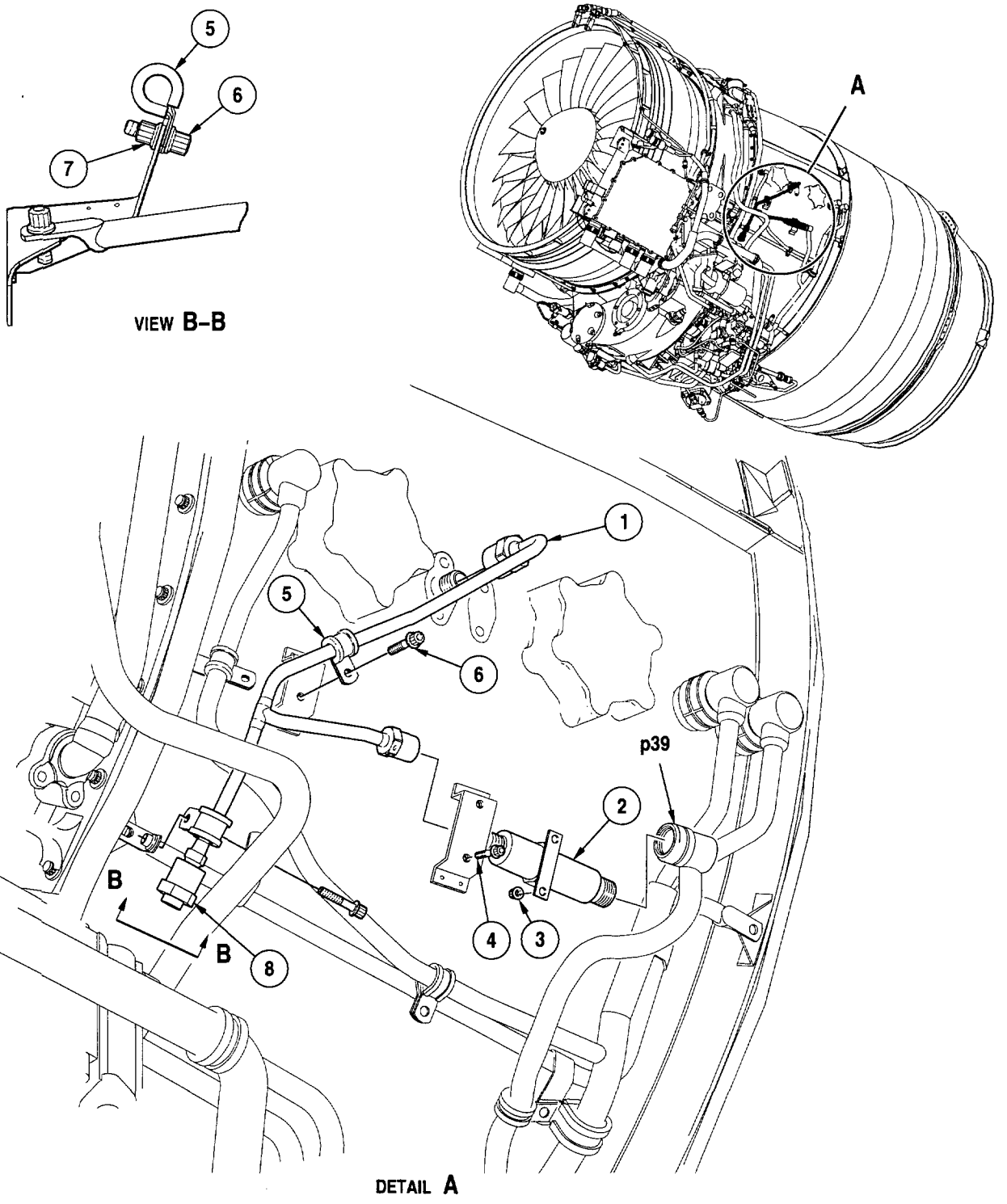
(1) Disconnect the P39 harness connector from P3 pressure transducer (2).

(2) Disconnect the coupling nut of P3 air tube (1) from the P3 pressure transducer (2).

(3) Remove two bolts (3) and two nuts (4) from the P3 pressure transducer (2).

(4) Remove the P3 pressure transducer (2).

(5) Remove P3 tube cap assembly (8).



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P3 Tubes and Transducer (Post-SB24434/Pre-SB24514) - Removal/Installation
Figure 202

Key to Figure 202

1 P3 Air Pressure Tube
2 P3 Pressure Transducer
3 Nut
4 Bolt
5 Clamp
6 Bolt
7 Nut
8 P3 Tube Cap Assembly

(6) Remove two bolts (6) and two nuts (7) and two clamps (5) securing the P3 tube (1).

(7) Remove P3 pressure tube (1).

D. Install P3 Tubes and Transducer (Post-SB24434/Pre-SB24514) (Ref. Fig. 202)

(1) Install the P3 pressure transducer (2) to the bracket on the bypass duct with two bolts (3) and two nuts (4). Torque the bolts hand tight.

(2) Install P3 air pressure tube (1) on the outer bypass duct. Tighten the coupling nuts with hand.

(3) Install two loop clamps (5), two bolts (6) and two nuts (7) on tube assembly (1). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(4) Torque the coupling nuts of tube assembly (1) 270 to 300 lb.in. (30.5-34.0 Nm) and lockwire with (PWC05-089).

(5) Install cap assembly (8) on P3 tube (1). Torque cap 270 to 300 lb.in. (30.5-34.0 Nm) and lockwire (PWC05-089).

CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN INSTALLING CONNECTORS.

CAUTION: MAKE SURE PLUGS AND RECEPTACLES ARE FREE FROM MOISTURE. IF NECESSARY, DRY WITH HEAT GUN.

CAUTION: DO NOT FORCE OR STRETCH HARNESS WHEN INSTALLING CONNECTORS OR FASTENING LOOP CLAMPS.

CAUTION: HARNESS CONNECTORS MUST BE ASSEMBLED WITH CLEAN, DRY THREADS. THE USE OF ENGINE OIL, SPRAY RELEASE AGENTS AND OTHER LUBRICANTS IS PROHIBITED.

CAUTION: INSTALL AND TORQUE CONNECTORS WITH APPROVED TOOLS ONLY. CONNECTORS ARE FULLY ENGAGED WHEN ONLY THE BLUE COLOR BAND IS VISIBLE. FINAL TORQUE OF THE CONNECTOR IS TO BE APPLIED USING SOFT-JAWED PLIERS

(6) Install harness connector P39 on transducer (2). Firmly grip the connector coupling nut with soft jawed pliers (PWC90012) and apply hand pressure to tighten the nut until the pliers slip.

NOTE: Measurement of the actual torque is not required.

VIGV ACTUATOR - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC03-001	Engine Oil
PWC05-089	Lockwire
PWC05-344	Safety Cable Kit

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC43311	Rigging Pin
PWC43312	Rigging Pin
PWC60142-100	Wrench
PWC60801	Fixture
PWC60899	Rigging Tool
PWC62458	Drift
PWC62502	Base
PWC62503	Drift
PWC62504	Base
PWC90025	Crimper
PWC90026	Test Block

4. Fixtures, Equipment and Supplier Tools

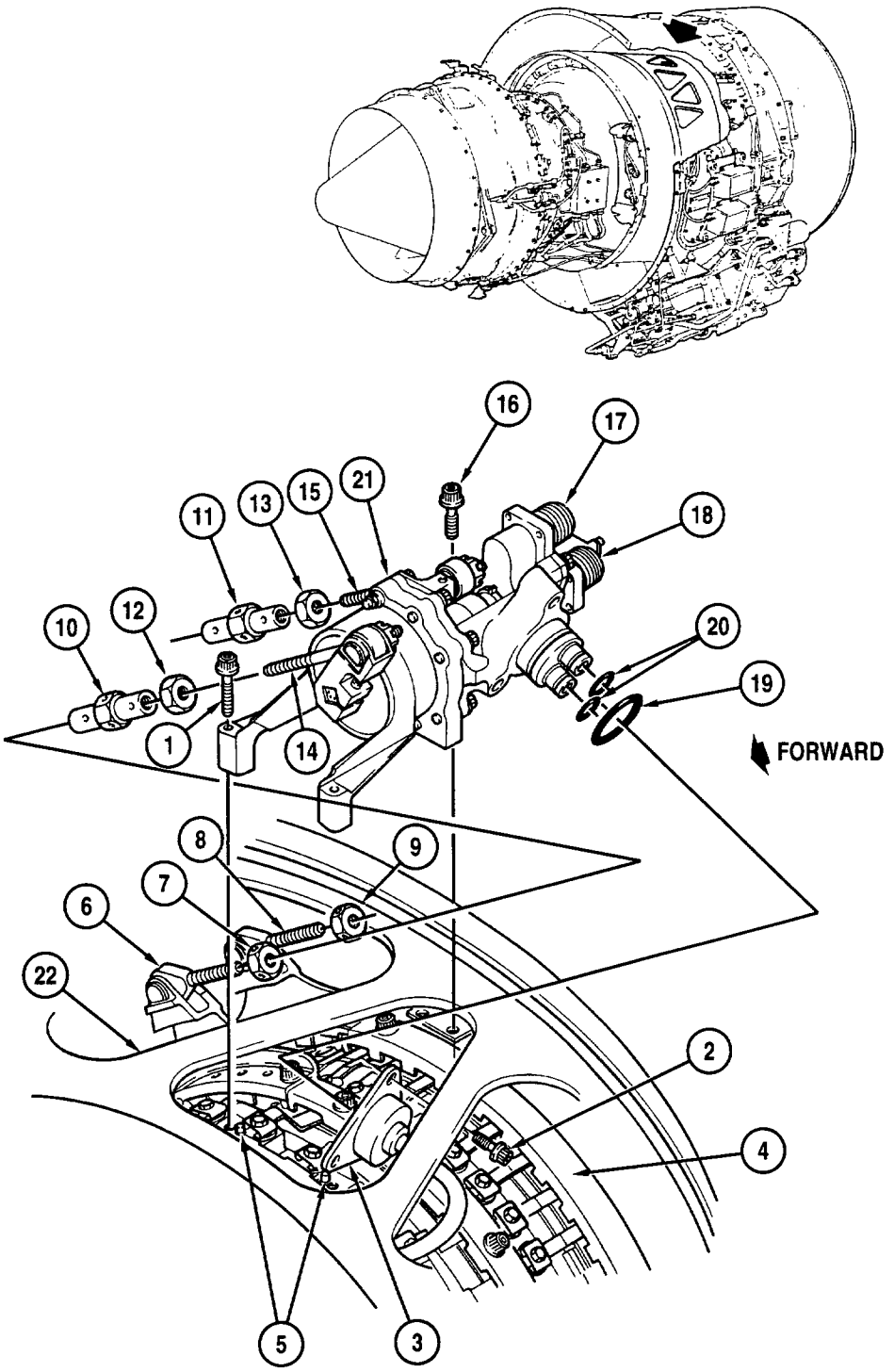
   Not Applicable

5. Rotary Stator Vane Actuator (Pre-SB24369)

   A. Removal (Ref. Fig. 201)

      (1) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).

      (2) Remove the access cowling and apron (Ref. Aircraft Maintenance Manual).



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Rotary Stator Vane Actuator (Pre-SB24369) - Removal/Installation
Figure 201

Key to Figure 201

1. Bolt
2. Bolt
3. Fuel Tube Assembly
4. HP Compressor Case
5. Locating Pin
6. Rod End, LH Thread
7. Nut, LH Thread
8. Rod End LH Thread
9. Nut LH Thread
10. Rod Internally Threaded
11. Rod Internally Threaded
12. Nut
13. Nut
14. Rod-end
15. Rod-end
16. Bolt
17. Connector (P25)
18. Connector (P24)
19. Preformed Packing
20. Preformed Packing
21. Rotary Stator Vane Actuator
22. Gas Generator Case (Ref.)

(3) Remove the upper, outer section of the bypass duct (Ref. 72-70-01, BYPASS DUCTS, MAINTENANCE PRACTICES).

(4) Remove the lower, inner, section of the bypass duct (Ref. 72-70-01, BYPASS DUCTS, MAINTENANCE PRACTICES).

(5) Remove electrical connectors from compressor bleed solenoid valve.

(6) Remove electrical connectors from connectors (18 and 17).

(7) Remove lockwire from nuts (7, 9, 12 and 13) and internally threaded adjusting rods (10 and 11). Loosen nuts (7, 9, 12 and 13).

(8) Remove threaded rods (10 and 11) and nuts (12 and 13) from actuator (21).

(9) Remove three bolts (2) securing fuel tube assembly (3) actuator to manifold.

(10) Remove two bolts (1) and two bolts (16) securing actuator to HP compressor case and remove actuator (21). Discard preformed packings (19 and 20).

B. Installation (Ref. Fig. 201)

(1) Install two preformed packings (20) and one preformed packing (19) on actuator (21).

(2) Install nut (13) on rod-end (15) and nut (12) on rod-end (14).

(3) Position actuator (21) on locating pins (5) on HP compressor case (4) with bolts (1 and 16). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(4) Secure fuel tube assembly (3) to actuator (21) with three bolts (2). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(5) Apply electrical contact enhancer to connectors (Ref. 70-00-00, CLEANING).

(6) Engage master keyway and install P24 connector (18) and P25 connector (17) on rotary stator vane actuator. Torque connectors 24 to 29 lb.in. (2.7-3.3 Nm.) using wrench (PWC60142-100).

(7) Rig actuator (Ref. Subpara. (C.) following.

C. Rigging Procedure (Ref. Fig. 202)

(1) Set vane actuator (1) in the OPEN position.

CAUTION: MAKE SURE ACTUATOR IS LOCKED IN THE OPEN POSITION.

(2) Install rigging pin (PWC43311) through "RIGGING PIN HOLE" to lock actuator.

(3) Move actuator rings (8 and 10) to the CLOSED position.

(4) Install nuts (4) on rod ends (2 and 3).

CAUTION: NUTS (6) AND ROD ENDS (7 and 9) ARE LEFT HAND THREAD.

(5) Install nuts (6) on rod ends (7 and 9).

(6) Measure and record dimension RL as follows:

NOTE: Dim. RL = The length of rod end (2) measured from the center of the bearing to the end of the threaded rod.

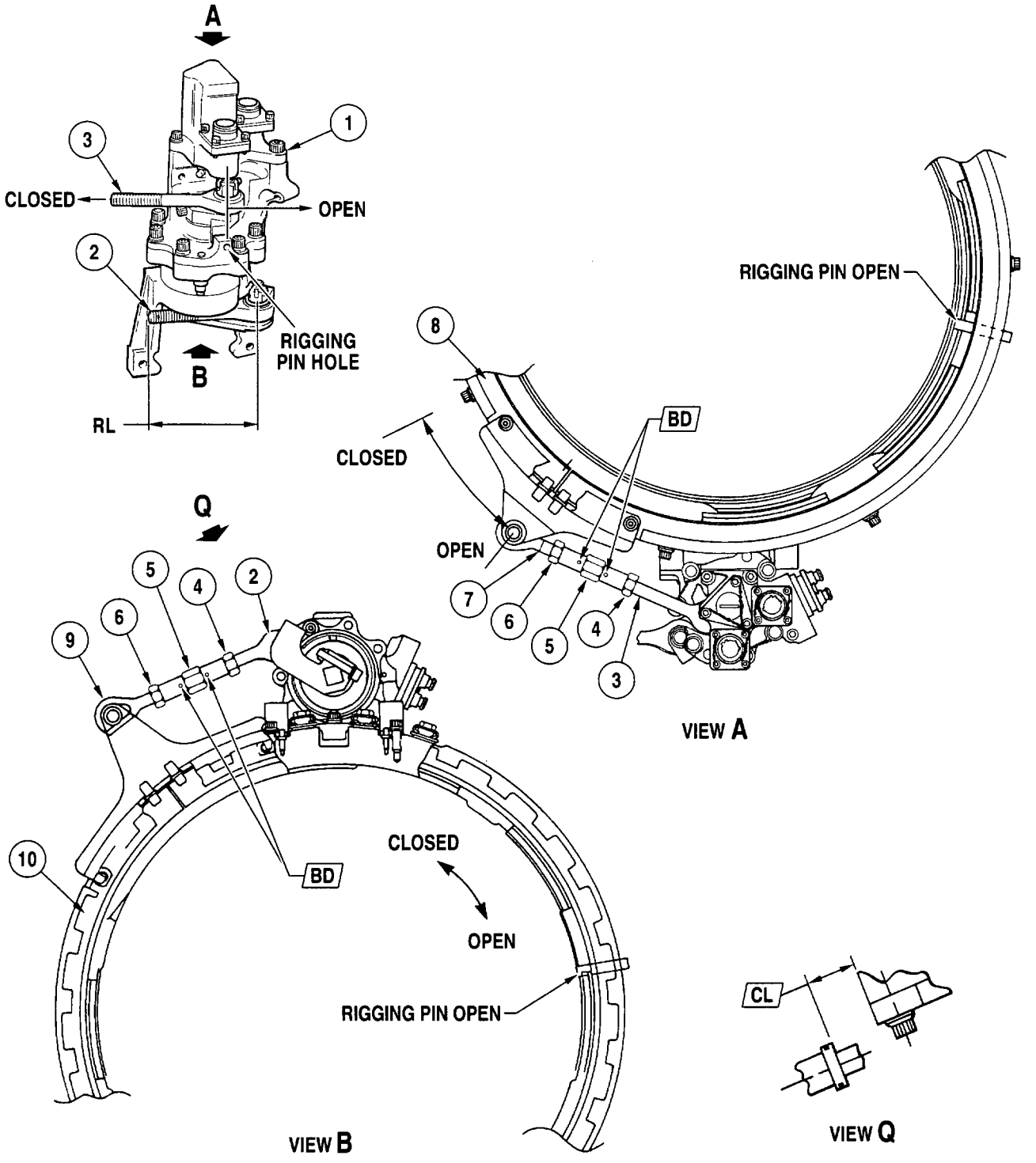
(a) If rod length measures 3.650 inch (Post-SB24038), proceed to step (9).

(b) If rod length measures 3.350 inch (Pre-SB24038), proceed with step (7), omit steps (9) and (10).

(7) Move ring (10) toward the open position until rod ends (2 and 9) engage with rod (5).

(8) Move ring (8) toward the open position until rod ends (3 and 7) engage with rod (5).

(9) Install one rod (5) seven full turns onto each rod end (7) and (9).

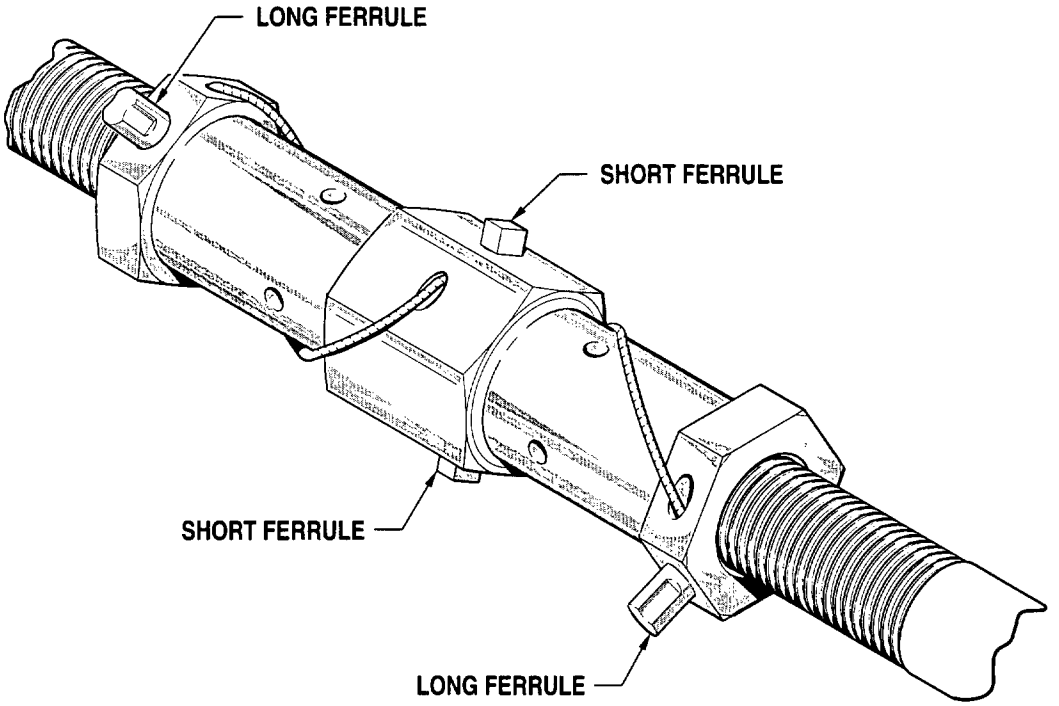


C28922

Rotary Stator Vane Actuator - Rigging
Figure 202 (Sheet 1 of 2)

Key to Figure 202

1. Actuator
2. Rod End, Inlet Guide Vane
3. Rod End, First-stage Vane
4. Nut
5. Internally Threaded Rod
6. Nut, LH Thread
7. Rod End, LH Thread
8. First-stage Vane Actuator Ring
9. Rod End, LH Thread
10. Inlet Guide Vane Actuator Ring



Preferred Safety Cable Installation C142143

Rotary Stator Vane Actuator - Rigging
Figure 202 (Sheet 2)

(10) Move actuator rings until rods (5) engage with rod ends (2) and (3).

(11) Adjust rod (5) of both rings until rigging pins (PWC43312) can be inserted into their related OPEN slots in the front HP compressor casing.

CAUTION: NUT (6) IS LEFT HAND THREAD.

(12) Hold VIGV actuator ring rod (5) and tighten lock nuts (4 and 6) to 90 to 100 lb.in. (10-11.3 Nm).

(13) Measure dimension CL between nut (4) and actuator (1). There must be a minimum clearance of 0.050 inch (1.27 mm).

(14) Insert a wire 0.050-0.055 inch (1.27-1.39 mm) diameter through holes BD in each of two rods (5). The wire must not pass through.

(15) Install safety cable (PWC05-344) on locknuts (6 and 4) and turnbuckle (5) independently with crimper (PWC90025) and test block (PWC90026).

NOTE: If possible, set safety cable short ferrule at turnbuckle hole (5).

(16) Remove rigging pins.

(17) Make sure that safety cable ferrules does not touch actuator bracket by moving actuator ring drive system to fully close and fully open position.

(18) Move both actuator rings to the fully closed position.

(19) Restore electrical power to appropriate system and reset EEC circuit breaker to ON.

(20) Select maintenance test discrete to OFF.

(21) Install the lower, inner, section of the bypass duct (Ref. 72-70-01, BYPASS DUCTS, MAINTENANCE PRACTICES).

(22) Install the upper, outer section of the bypass duct (Ref. 72-70-01, BYPASS DUCTS, MAINTENANCE PRACTICES).

(23) Install the access cowling and apron (Ref. Aircraft Maintenance Manual).

(24) Refer to Chapter 71-00-00 for checks following installation of IGV actuator.

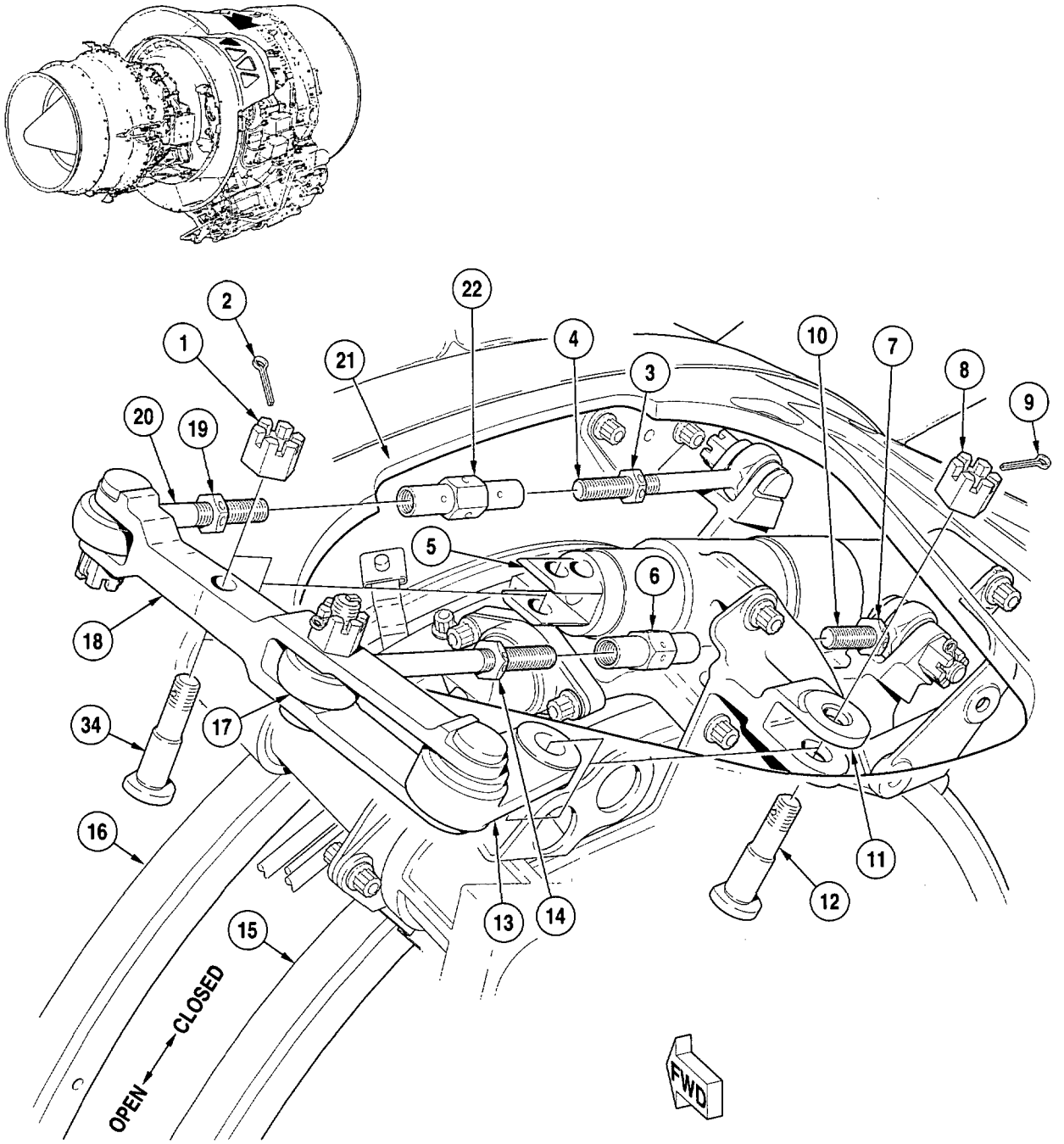
(25) Pull EEC circuit breaker to OFF.

6. Linear Stator Vane Actuator (Post-SB24369)

A. Remove Linear Stator Vane Actuator (Post-SB24369) (Ref. Fig. 203)

CAUTION: USE ONLY APPROVED TOOLING TO LOOSEN HARNESS CONNECTORS.

(1) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).

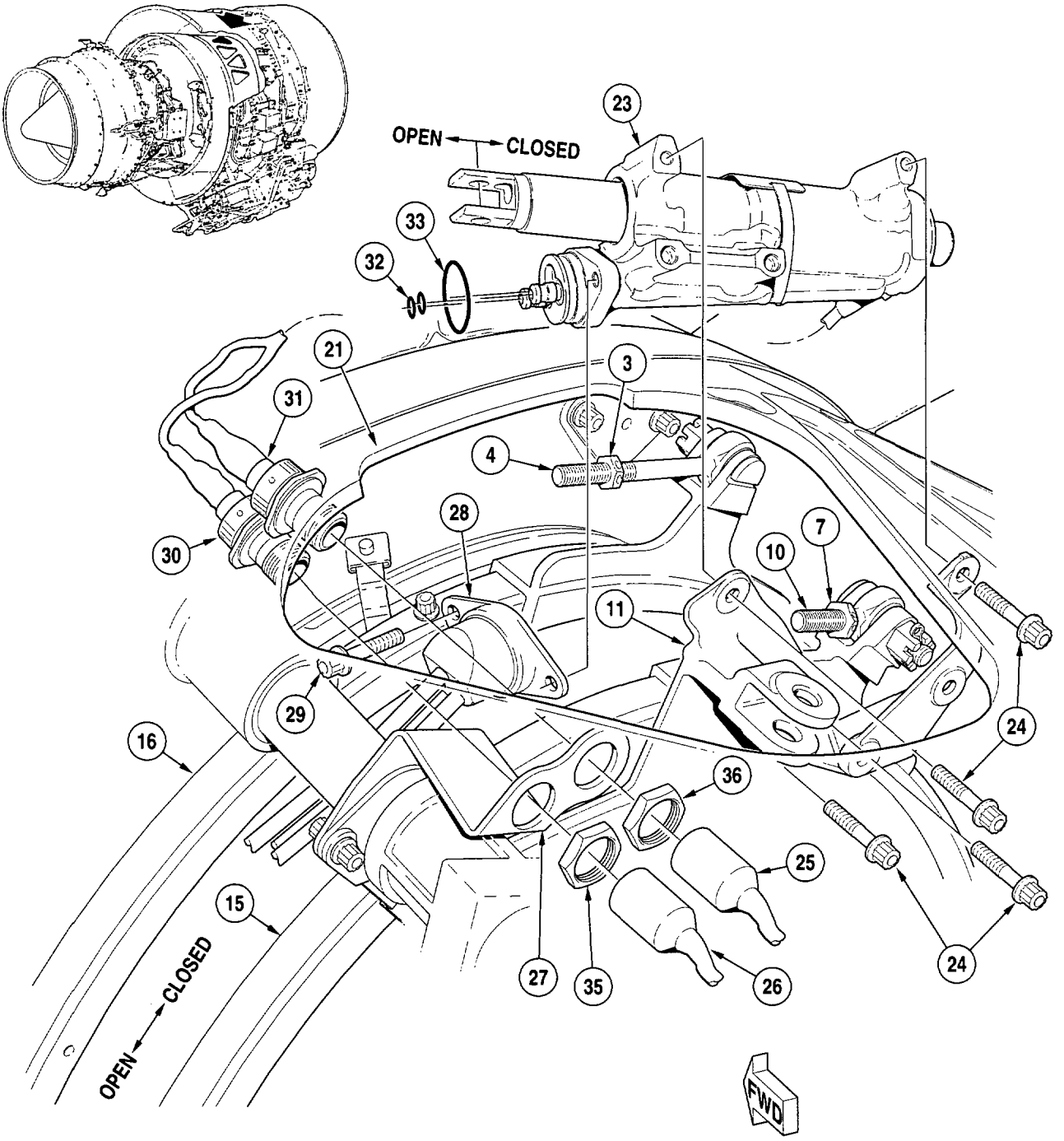


C35374

Removal/Installation of Linear Stator Actuator (Post-SB24369)
Figure 203 (Sheet 1 of 2)

Key to Figure 203

1. Nut
2. Cotter Pin
3. Nut
4. Rod-end
5. Actuator Shaft
6. Threaded Rod
7. Nut
8. Nut
9. Cotter Pin
10. Rod-end
11. Actuator Mounting Bracket
12. D-head Bolt
13 Yoke
14. Nut
15. First-stage Vane Actuator Ring
16. Inlet Guide Vane Actuator ring
17. Rod-end
18. Master Lever
19. Nut
20. Rod End
21. Gas Generator Case Assembly
22. Threaded Rod
23. Linear Stator Vane Actuator
24. Bolt
25. P25 Connector
26. P24 Connector
27. Actuator Harness Connector Mounting Bracket
28. Fuel Pressure Tube Assembly
29. Bolt
30. Harness Connector
31. Harness Connector
32. Preformed Packing
33. Preformed Packing



C35375

Removal/Installation of Linear Stator Actuator (Post-SB24369)
Figure 203 (Sheet 2)

(2) Remove the access cowling and apron (Ref. Aircraft Maintenance Manual).

(3) Remove the upper, outer section of the bypass duct (Ref. 72-70-01, BYPASS DUCTS, MAINTENANCE PRACTICES).

(4) Remove the lower, inner, section of the bypass duct (Ref. 72-70-01, BYPASS DUCTS, MAINTENANCE PRACTICES).

(5) Disconnect electrical connectors from the compressor bleed solenoid valve using wrench (PWC60142-100).

(6) Remove lockwire or safety cable from nuts (3, 19, 7 and 14) and internally threaded adjusting rods (22 and 6).

(7) Loosen nuts (3, 19, 7 and 14).

(8) Move actuator shaft (5) to the closed position.

(9) Remove cotter pin (9), nut (8) and bolt (12).

CAUTION: DO NOT ATTEMPT TO REMOVE THE OTHER THREE BOLTS FROM THE MASTER LEVER (23). THESE BOLTS HAVE A TIGHT FIT AND SHOULD BE REMOVED IN A OVERHAUL FACILITY, IF REQUIRED.

(10) Remove cotter pin (2), and nut (1).

(11) Remove bolt (34) securing the actuator rod to the master lever.

CAUTION: EXTREME CARE MUST BE TAKEN TO NOT BEND OR CAUSE ANY UNDUE STRESS TO TUBE ASSEMBLY DURING REMOVAL OF ACTUATOR

(12) Remove two bolts (29) attaching fuel tube assembly (28) to actuator manifold. Loosen or remove bolts along the length of tube assembly (28) as necessary to ease retraction.

(13) Remove threaded rods (6 and 22). Remove master lever (18).

(14) Disconnect the P24 and P25 connectors (25 and 26). Remove four clamps/brackets securing the actuator harness. Record the positions and locations of the clamps and brackets.

(15) Remove the actuator harness connector attaching nuts (35 and 36). Remove connector (30 and 31).

(16) Remove four bolts (24) securing actuator to mounting bracket (11). Remove actuator (23).

(17) Remove and discard preformed packings (32 and 33).

(18) Install protective covers on all tube and actuator openings.

B. Disassembly of Linear Stator Vane Actuator Lever (Post-SB24502) (Ref. Fig. 204)

(1) Remove cotter pins (8) and nuts (7).

(2) Remove bolts (4) and hollow pins (1) from master lever (3) with base (PWC62504) and drift (PWC62503).

(3) Remove rod end connectors (2 and 5) from master lever (3).

(4) Remove yoke (6) from the master lever (3).

C. Assembly of Linear Stator Vane Actuator Lever (Post-SB24502) (Ref. Fig. 204)

(1) Lubricate outside diameter of hollow pins (1) and threads of bolts (4) with engine oil (PWC03-001).

(2) Install hollow pin (1) through master lever (3) and rod end connector (2) with base (PWC62502) and drift (PWC62458) until it is flush with the master lever (3) (Ref. F & C REF. NO. 1358 and 1360).

(3) Install hollow pin (1) through master lever (3) and rod end connector (5) with base (PWC62504) and drift (PWC62458) until it is flush with the master lever (3) (Ref. F & C REF. NO. 1353 and 1357).

(4) Install hollow pin (1) through master lever (3) and yoke (6) with drift (PWC62458) until it is flush with the master lever (3) (Ref. F & C REF. NO. 1359 and 1361).

(5) Install bolts (4) through hollow pins (1) and secure with nuts (7). Torque bolts 36 - 40 lb. in. (4.1-4.5 Nm).

(6) Install cotter pins (8) through bolts (4) and nuts (7). Lock the cotter pins (8).

D. Removal of Rod End Connectors (Post-SB24502) (Ref. Fig. 205)

(1) Remove cotter pin (2) and castle nut (3) from bolt (6) (Ref. View A).

(2) Remove bolt (6) and hollow pin (5) from connecting bracket (1) with base (PWC62504) and drift (PWC62503) (Ref. View A).

(3) Remove rod end connector (4) from link bracket (1) (Ref. View A).

(4) Remove cotter pin (2) and castle nut (3) from bolt (6) (Ref. View B).

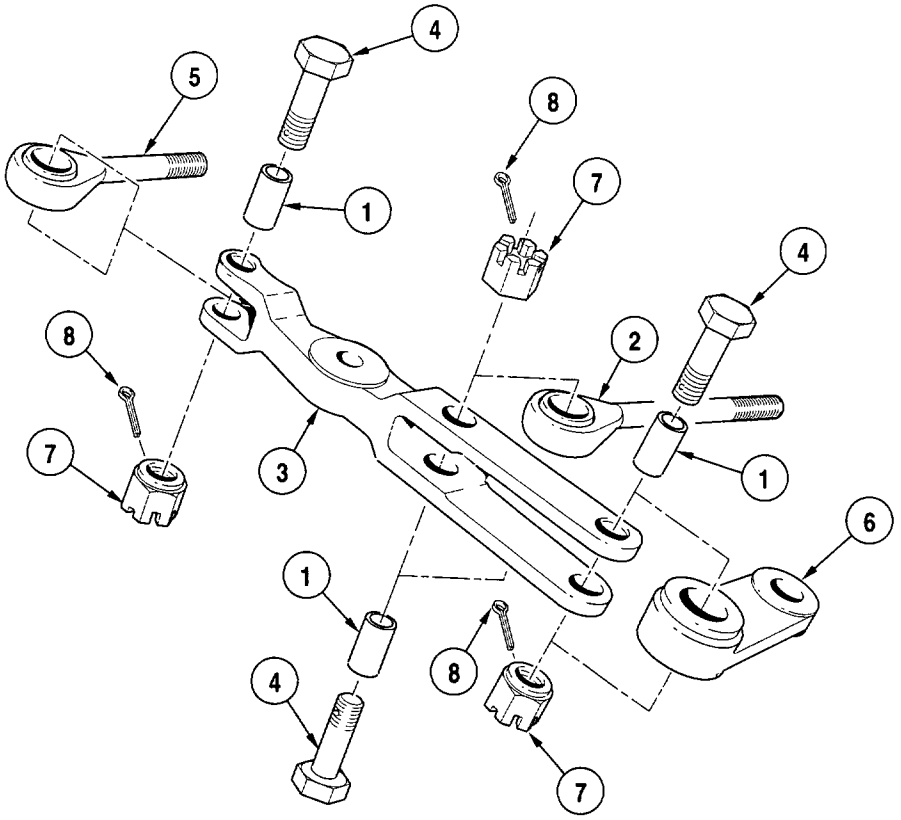
(5) Remove bolt (6) and hollow pin (5) from connecting bracket (7) with base (PWC62504) and drift (PWC62503) (Ref. View B).

(6) Remove rod end connector (8) from link bracket (7) (Ref. View B).

E. Installation of Rod End Connectors (Post-SB24502) (Ref. Fig 205)

(1) Lubricate outside diameter of hollow pin (5) and threads of the bolt (6) with engine oil (PWC03-001) (Ref. View A).

(2) Install hollow pin (5) through connecting link bracket (1) and rod-end connector (4) with base (PWC62504) and drift (PWC62503), until it is flush with the surfaces of connecting link bracket (1) (Ref. View A) (Ref. F & C REF. NO. 1072 and 1073).



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Disassembly/Assembly of Linear Stator Vane Actuator Lever (Post-SB24502)
Figure 204

Key to Figure 204

1. Hollow Pin
2. Rod End Connector
3. Master Lever
4. Bolt
5. Rod End Connector
6. Yoke
7. Castle Nut
8. Cotter Pin

(3) Install bolt (6) through hollow pin (5). Secure with nut (3). Torque 36 to 40 lb.-in. (4.1-4.5 Nm) (Ref. View A).

(4) Install cotter pin (2) through bolt (6) and nut (3). Lock the cotter pin (2) (Ref. View A).

(5) Lubricate outside diameter of hollow pin (5) and threads of the bolt (6) with engine oil (PWC03-001) (Ref. View B).

(6) Install hollow pin (5) through connecting link bracket (7) and rod-end connector (8) with base (PWC62504) and drift (PWC62503), until it is flush with the surfaces of connecting link bracket (7) (Ref. View B) (Ref. F & C REF. NO. 1069 and 1070).

(7) Install bolt (6) through hollow pin (5). Secure with nut (3). Torque 36 to 40 lb.-in. (4.1-4.5 Nm) (Ref. View B).

(8) Install cotter pin (2) through bolt (6) and nut (3). Lock the cotter pin (2) (Ref. View B).

F. Installation of Linear Stator Vane Actuator (Post-SB24369) (Ref. Fig. 203)

(1) Apply anti-seize compound (PWC06-004) on the threads of connecting rod-ends (20, 17, 4 and 10).

(2) Install nut (7) on rod-end (10).

NOTE: Left hand thread.

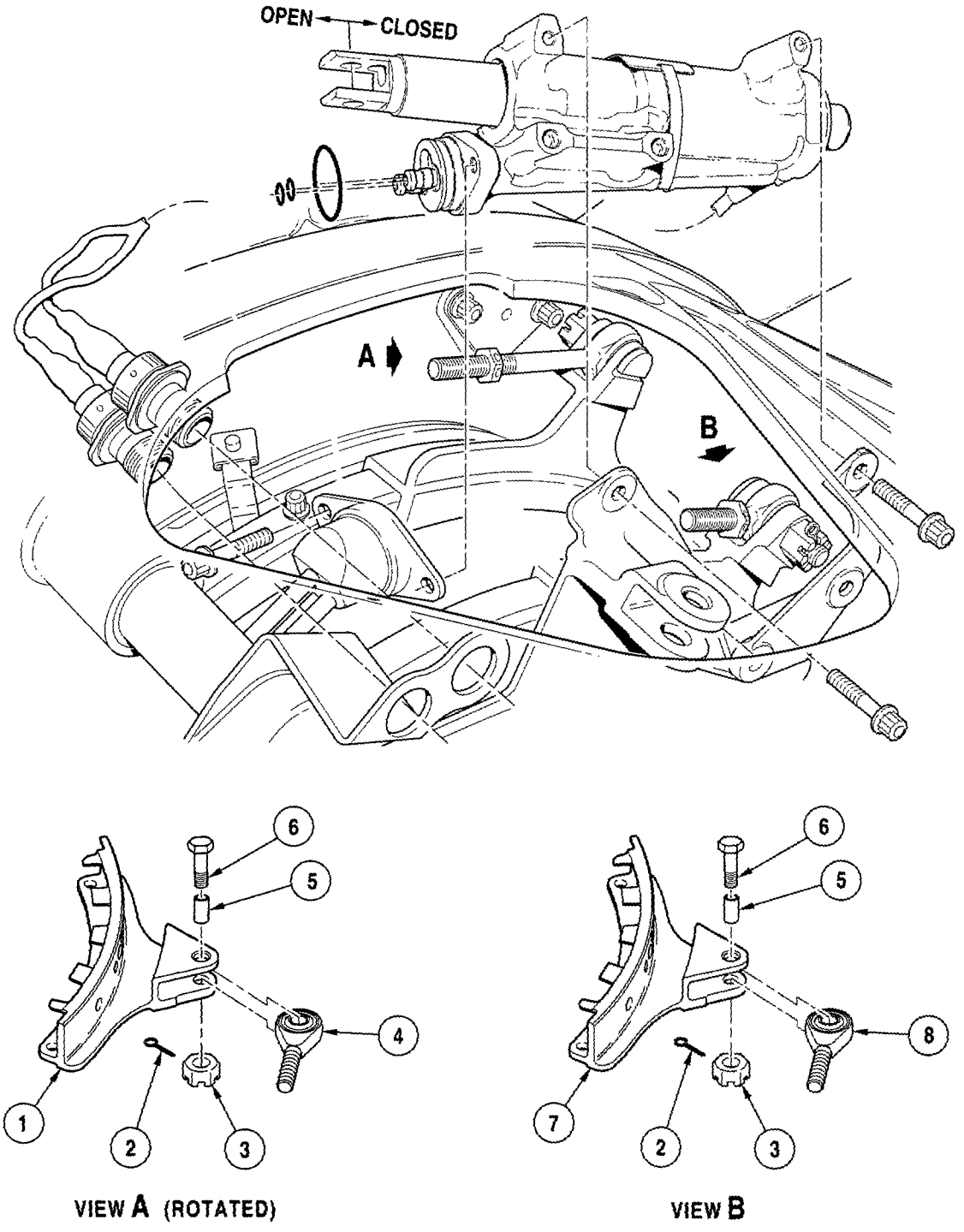
(3) Install nut (19) on rod-end (20).

NOTE: Left hand thread.

(4) Install nut (3) on rod-end (4).

(5) Install nut (14) on rod-end (17).

(6) Connect lever support (13) to bracket (11) with bolt (12) and nut (8). Torque nut 90 to 100 ib. in. (10.1-11.3 Nm). Install cotter pin (9).



C113431

Removal/Installation of Rod End Connectors (Post-SB24502)
Figure 205

Key to Figure 205

1. Connecting Link Bracket
2. Cotter Pin
3. Castellated Nut
4. Rod End Connector
5. Hollow pin
6. Bolt
7. Connecting Link Bracket
8. Rod End Connector

CAUTION: START TURNING BOTH THREADED RODS ONTO THE ROD-ENDS AT THE SAME TIME TO ENSURE EQUAL ADJUSTMENT DISTANCE AT BOTH ENDS.

(7) Install threaded rod (6) on rod-ends (17 and 10) and threaded rod (22) on rod-ends (4 and 20).

(8) Lubricate and install two new preformed packings (32) and one new preformed packing (33) on actuator (23) using engine oil (PWC03-001).

(9) Install actuator (23) engaging tube assembly (5). Attach actuator with four bolts (24). Torque 36 to 40 lb. in. (4.0-4.6 Nm).

(10) Apply electrical contact enhancer to connectors.

(11) Install harness connectors (30 and 31) onto connectors (25 and 26) with nuts (35 and 36). Torque nuts 40 to 45 lb. in. (4.52-5.08 Nm). Install lockwire (PWC05-089).

CAUTION: TITANIUM PARTS. WEAR CLEAN, LINT-FREE GLOVES AND HANDLE WITH CARE.

(12) Move inlet guide vane (16) and first-stage vane rings (15) to the closed position.

(13) Move actuator rod (5) toward the open position until the rod engages the lever assembly (18) and the bolt holes are aligned.

(14) Apply anti-seize compound (PWC06-004) to the threads of bolt (34).

(15) Install D-head bolt (34) through rod (5) and the bearings in lever (18). Engage the flat on the bolt with the shoulder on the rod.

(16) Install nut (1) as follows:

CAUTION: DO NOT COMPRESS THE BEARINGS.

(a) Tighten the nut until all axial movement is removed from the bolt.

(b) Install cotter pin (2).

NOTE: If the cotter pin cannot be installed, loosen the nut until the next castellation is aligned with the hole in the bolt.

G. Adjust Linear Stator Vane Actuator Linkage (Post-SB24369)

(1) For linear stator vane actuator linkage adjustment refer to 75-30-04, VIGV ACTUATOR - MAINTENANCE PRACTICES, Fits and Clearances, REF. NO. 1805.

7. Fits, Clearances and Torque Loadings

A. General

The following pages provide the fits and clearances, torques, spring pressures, special assembly, and backlash checks.

All tables have metric equivalents given in parentheses either beside or below the imperial measurements.

For all tables, the indicated REF. NO. can be found on the Figure following the last table.

B. Dimensional Checks

The DIMENSIONS FOR REF. column indicates minimum and maximum manufacturing dimensions of two mating parts. These dimensions are provided for information only.

The LIMITS column indicates the desired minimum and maximum fits and clearances between new parts, and also the allowable limit to which these parts may wear before replacement is necessary.

The letter T indicates a tight fit; L or no letter, a loose fit.

BY SELECTION means parts must be matched by selection to provide a required fit.

FIT TO means a fitting operation may be required at assembly to obtain the required fit.

An asterisk (*) indicates part(s) should be replaced if any looseness is evident.

Unless otherwise stated, all fits are diametrical. Spline fits are calculated from chordal dimensions.

C. Torque Limits

Unless otherwise stated, apply thread lubricant to all parts that are to be torque-loaded.

Use engine lubricating oil or equivalent, unless otherwise specified.

Where torque limits for castle nuts are provided in the MINIMUM column only, these nuts should be tightened to the designated torque and then further tightened, if necessary, to properly align the locking slots and holes.

Where MINIMUM and MAXIMUM values are given, the alignment of the locking slot must be obtained without loosening the nut and without exceeding the maximum limit. If this is not possible, back-off the nut half a turn, then retighten. If alignment cannot be accomplished, select another nut.

Torque requirements for interference fit applications, such as studs, may be obtained with or without lubrication, unless otherwise specified.

TABLE 201, Fits and Clearances

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1069	Post-SB24502 Pin - Hollow	0.3125 7.937	0.3130 7.950	0.001T 0.025T	0.000 0.000	
	Connector - Rod-End	0.3120 7.925	0.3125 7.937			
	NOTE: Rod-end connector is left hand thread.					
1070	Post-SB24502 Pin - Hollow	0.3125 7.937	0.3130 7.950	0.003T 0.076T	0.000 0.000	
	Bracket - Connecting Link	0.3100 7.874	0.3125 7.937			
1072	Post-SB24502 Pin - Hollow	0.3125 7.937	0.3130 7.950	0.001T 0.025T	0.000 0.000	
	Connector - Rod-End	0.3120 7.925	0.3125 7.937			
	NOTE: Rod-end connector is left hand thread.					
1073	Post-SB24502 Pin - Hollow	0.3125 7.937	0.3130 7.950	0.003T 0.076T	0.000 0.000	
	Bracket- Connecting Link	0.3100 7.874	0.3125 7.937			
1353	Post-SB24502 Pin - Hollow	0.3125 7.938	0.3130 7.950	0.001T 0.025T	0.000 0.000	
	Lever - Actuator	0.3120 7.925	0.3125 7.938			

TABLE 201, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
1357	Post-SB24502 Pin - Hollow	0.3125 7.938	0.3130 7.950	0.001T 0.025T	0.000 0.000	
	Bearing Plain - Spherical	0.3120 7.925	0.3125 7.938			
1358	Post-SB24502 Pin - Hollow	0.3125 7.938	0.3130 7.950	0.001T 0.025T	0.000 0.000	
	Bearing Plain - Spherical	0.3120 7.925	0.3125 7.938			
1359	Post-SB24502 Pin - Hollow	0.3125 7.938	0.3130 7.950	0.001T 0.025T	0.000 0.000	
	Bearing Plain - Spherical	0.3120 7.925	0.3125 7.938			
1360	Post-SB24502 Pin - Hollow	0.3125 7.938	0.3130 7.950	0.001T 0.025T	0.000 0.000	
	Bearing Plain - Spherical	0.3120 7.925	0.3125 7.938			
1361	Post-SB24502 Pin - Hollow	0.3125 7.938	0.3130 7.950	0.001T 0.025T	0.000 0.000	
	Bearing Plain - Spherical	0.3120 7.925	0.3125 7.938			

TABLE 202, Torque and Stretch

REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		

TABLE 203, Spring Pressure

REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		

TABLE 204, Special Assembly Procedures

REF. NO.	Name	Limits Min.	Limits Max.
1805	Linear Actuator Rigging Procedure (Post-SB24369)		

(1) Install linear actuator having push/pull linkages length initially set.

NOTE: Length is obtained by starting the threading of turnbuckle and threaded rod ends in unison.

(2) Move the compressor variable vane drive system towards "OPEN" position until the rigging hole in the guide vane unison ring EA and the rigging slot in the front HPC case allows rigging pin (PWC43312) AZ to be inserted (Ref. Fig. 207).

(3) Set actuator rod to open position and install rigging tool (PWC60899) between the rod and the rigging hole in the actuator body to set the actuator rod dimension DZ to 1.7775 to 1.7825 inches (Ref. Fig. 207)

(4) Adjust the turnbuckle AY until the rigging hole in the first stage vane unison ring DX and the rigging slot in the front HPC case allows rigging pin AZ (PWC43312) to be inserted.

(5) Insert a wire 0.050 - 0.055 inch Dia. through the holes BD on each of the turnbuckles AY. the wire must not pass through.

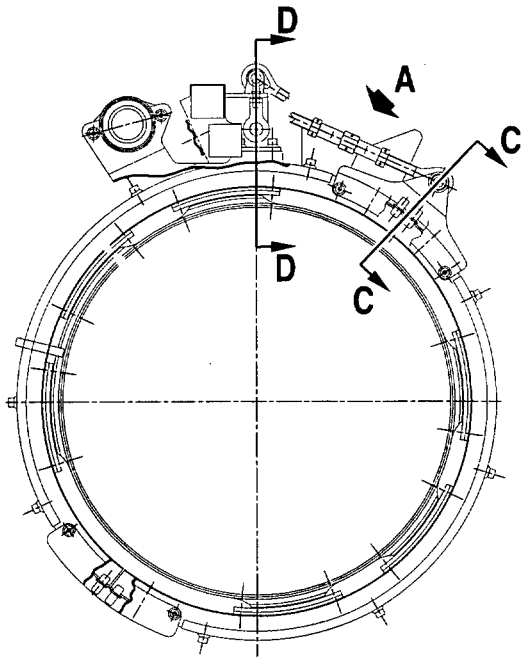
(6) Torque the locknuts AX of the turnbuckles AY 90 to 100 lb. in. (10.2-11.3 Nm). Lockwire the locknuts AX.

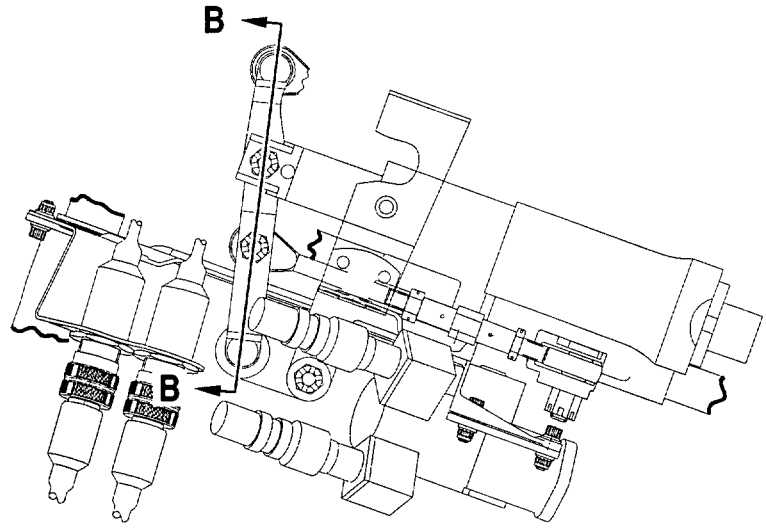
(7) Remove the rigging pins AZ (PWC43312) and rigging tool (PWC60899).

(8) Move the actuator rods to the fully closed position.

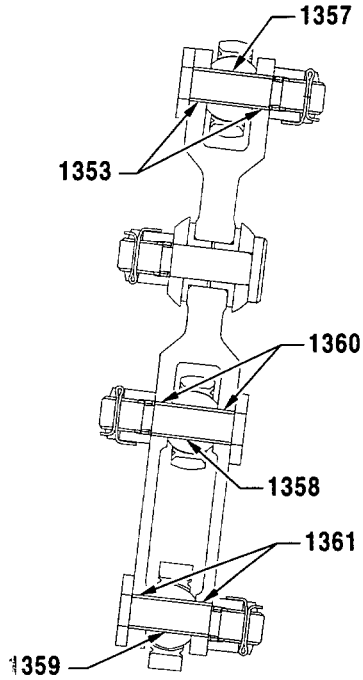
TABLE 205, Backlash

REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		

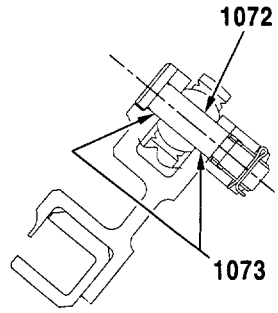




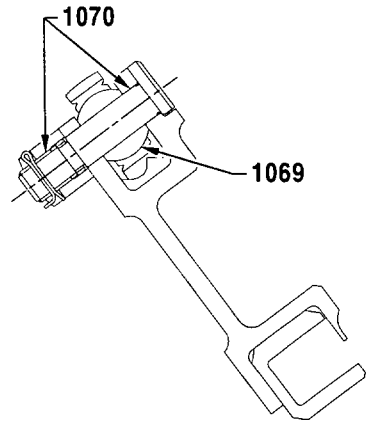
VIEW A



SECTION B-B
POST-SB24502



SECTION C-C
POST-SB24502



SECTION D-D
POST-SB24502

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Linear Actuator Lever Post-SB24502 - Fits and Clearances
Figure 206

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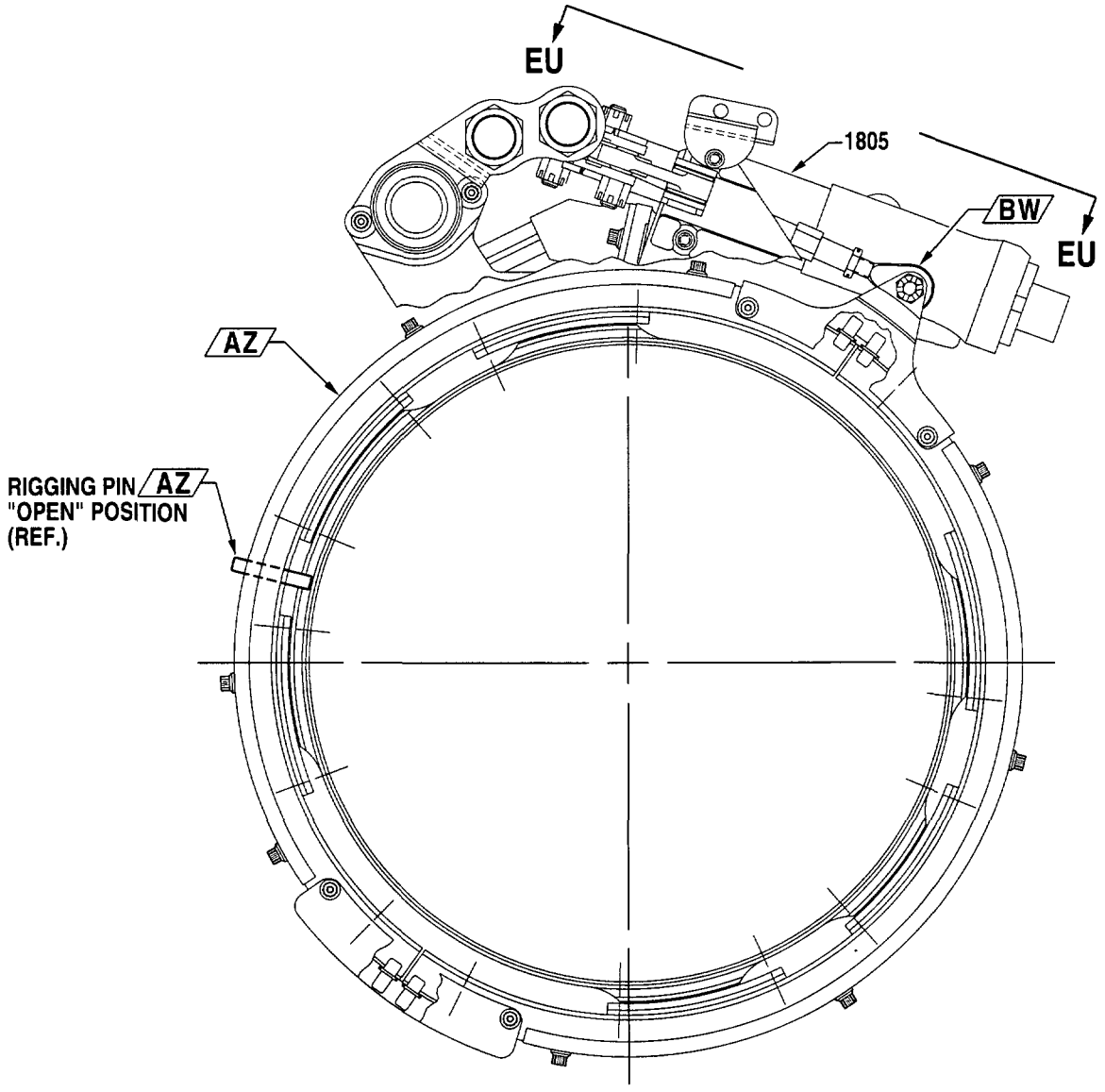

VIEW LOOKING FORWARD WITH HARNESS AND TUBES
OMITTED FOR CLARITY

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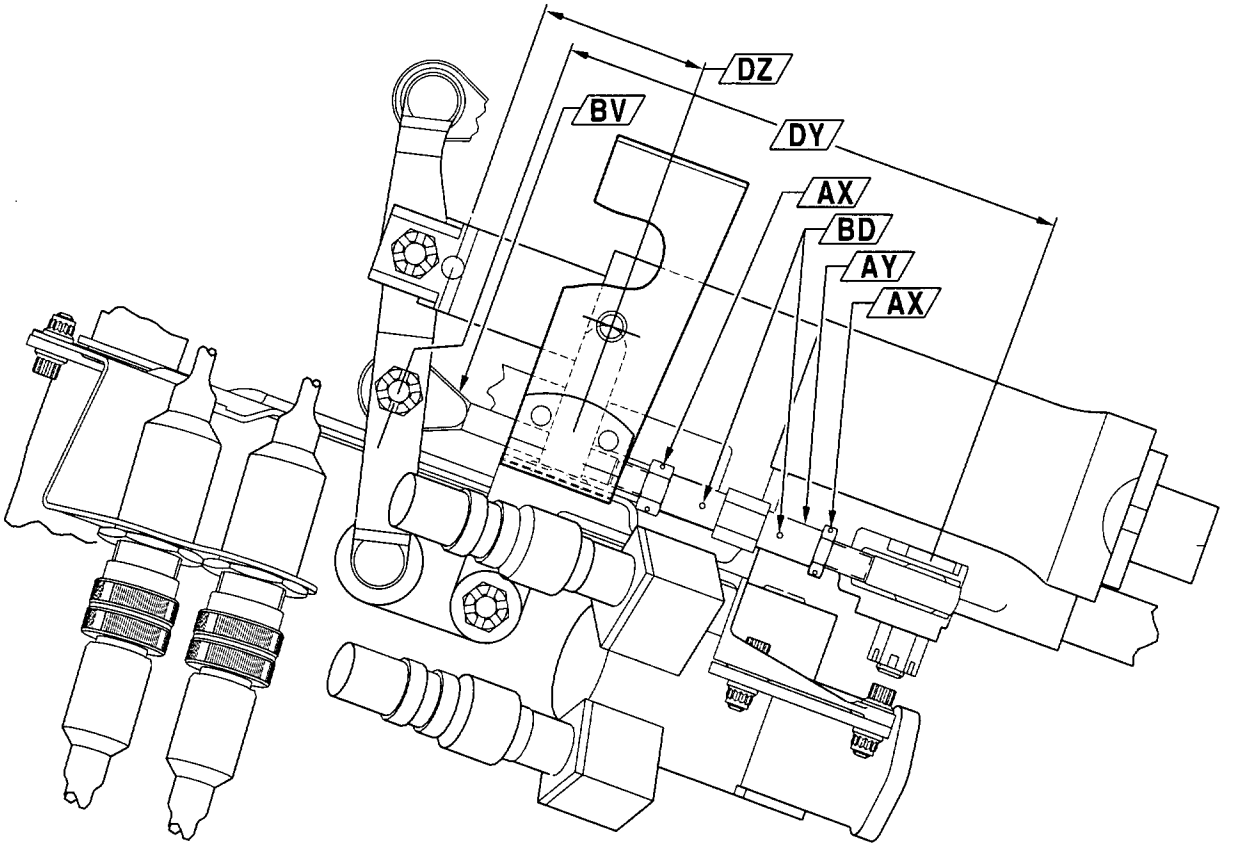
Linear Actuator Rigging Procedure Post-SB24369 - Fits and Clearances
Figure 207 (Sheet 1 of 2)



VIEW EU-EU

C28277

Linear Actuator Rigging Procedure Post-SB24369 - Fits and Clearances
Figure 207 (Sheet 2)

CHAPTER

77

ENGINE INDICATING

TABLE OF CONTENTS

SUBJECT	PAGE
SPEED SENSORS - MAINTENANCE PRACTICES	**77-10-01**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. N1 Speed Sensors	201
A. Removal	201
B. Installation	208
6. N2 Speed Sensors	215
A. Channel A - Removal	215
B. Channel A - Installation	215
C. Channel B - Removal	215
D. Channel B - Installation	217

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	May 30/2008
	2 blank	May 30/2008
Contents	1	May 30/2008
	2 blank	May 30/2008
77-10-01 Maintenance Practices	201	May 30/2008
	202	May 30/2008
	203	May 30/2008
	204	May 30/2008
	205	May 30/2008
	206	May 30/2008
	207	May 30/2008
	208	May 30/2008
	209	May 30/2008
	210	May 30/2008
	211	May 30/2008
	212	May 30/2008
	213	May 30/2008
	214	May 30/2008
	215	May 30/2008
	216	May 30/2008
	217	May 30/2008
	218 blank	May 30/2008

SPEED SENSORS - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC06-009	Compound, Antiseize

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC60142-100	Wrench

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. N1 Speed Sensors

   CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN REMOVING/INSTALLING CONNECTORS.

   A. Removal (Ref. Fig. 201, 202 and 203)

      (1) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).

      (2) Disconnect N1 speed sensor cables from N1/T4.5 terminal box (Ref. Ch. 77-20-01, T4.5 THERMOCOUPLES - MAINTENANCE PRACTICES).

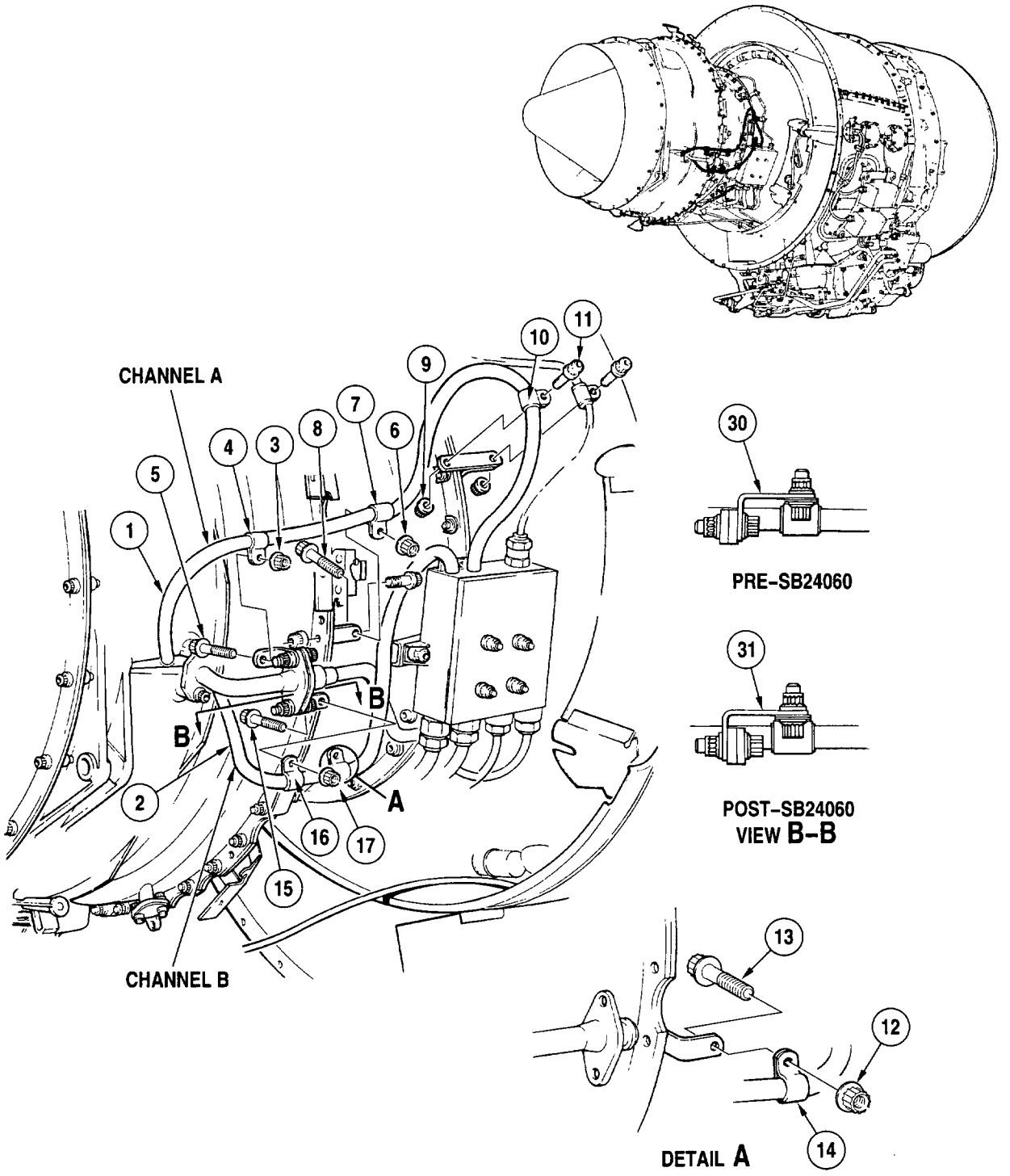
      (3) Channel A removal (Ref. Fig. 201):

         (a) Remove bolt (11, Sht. 1), self-locking nut (9) and loop clamp (10).

            NOTE: The locations of Channel A and B N1 sensors in the exhaust case are reversed for Post-SB24131 sensors (Ref. Fig. 202).

         (b) Remove bolt (8, Fig. 201, Sht. 1), self-locking nut (6) and loop clamp (7).

         (c) Remove bolt (5), self-locking nut (3) and loop clamp (4).

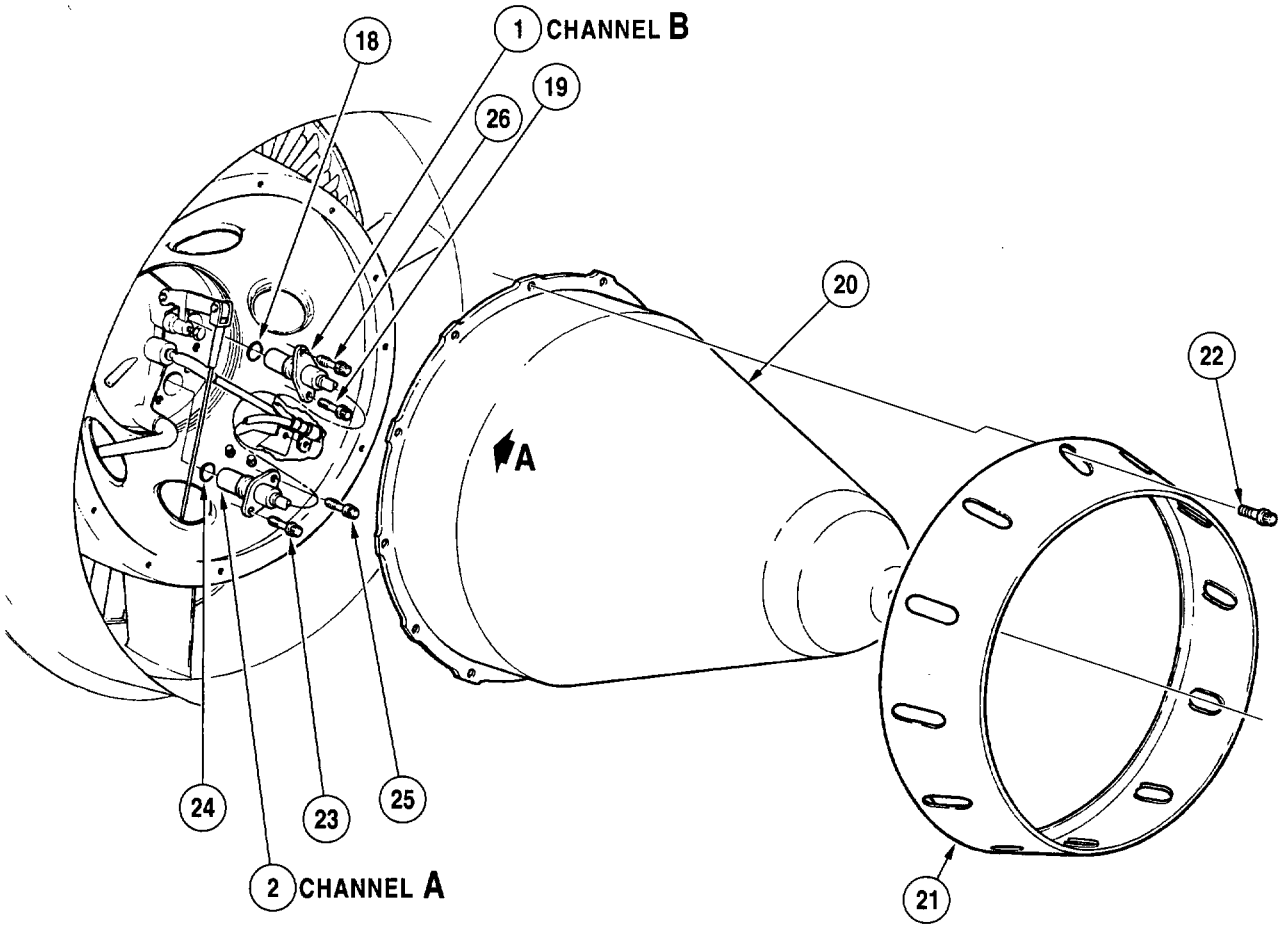


C20636C

N1 Speed Sensors - SB24060, SB24037 - Removal/Installation
Figure 201 (Sheet 1 of 3)

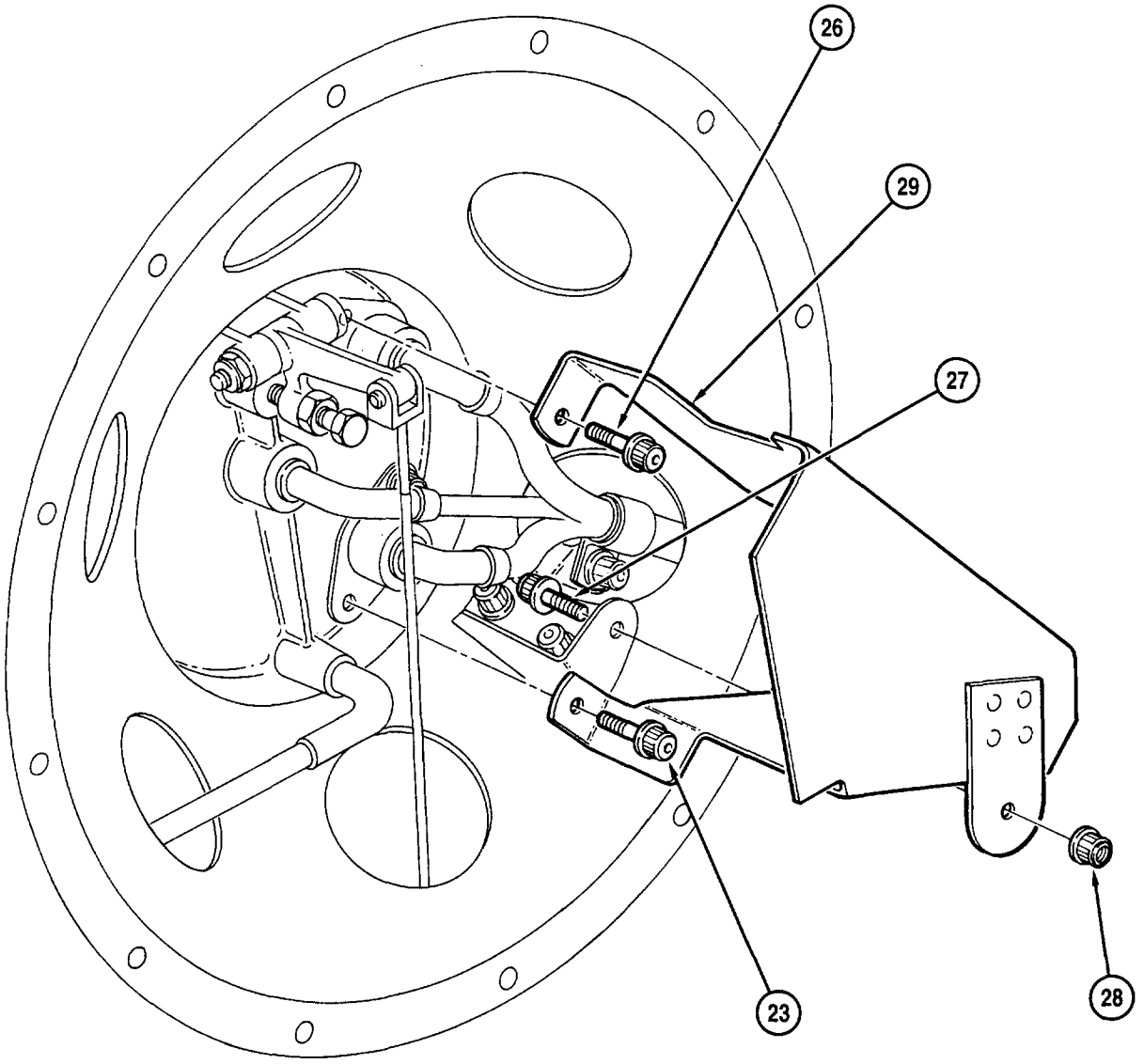
Key to Figure 201

1. N1 Speed Sensor (Channel A)
2. N1 Speed Sensor (Channel B)
3. Self-locking Nut
4. Loop Clamp
5. Bolt
6. Self-locking Nut
7. Loop Clamp
8. Bolt
9. Self-locking Nut
10. Loop Clamp
11. Bolt
12. Self-locking Nut
13. Bolt
14. Loop Clamp
15. Bolt
16. Loop Clamp
17. Self-locking Nut
18. Preformed Packing
19. Bolt
20. Exhaust Cone
21. Cone Shield
22. Bolt
23. Bolt
24. Preformed Packing
25. Bolt
26. Bolt
27. Bolt (Post-SB24037)
28. Self-locking Nut (Post-SB24037)
29. Heat Shield (Post-SB24037)
30. Bracket (Pre-SB24060)
31. Bracket (Post-SB24060)



C20637B

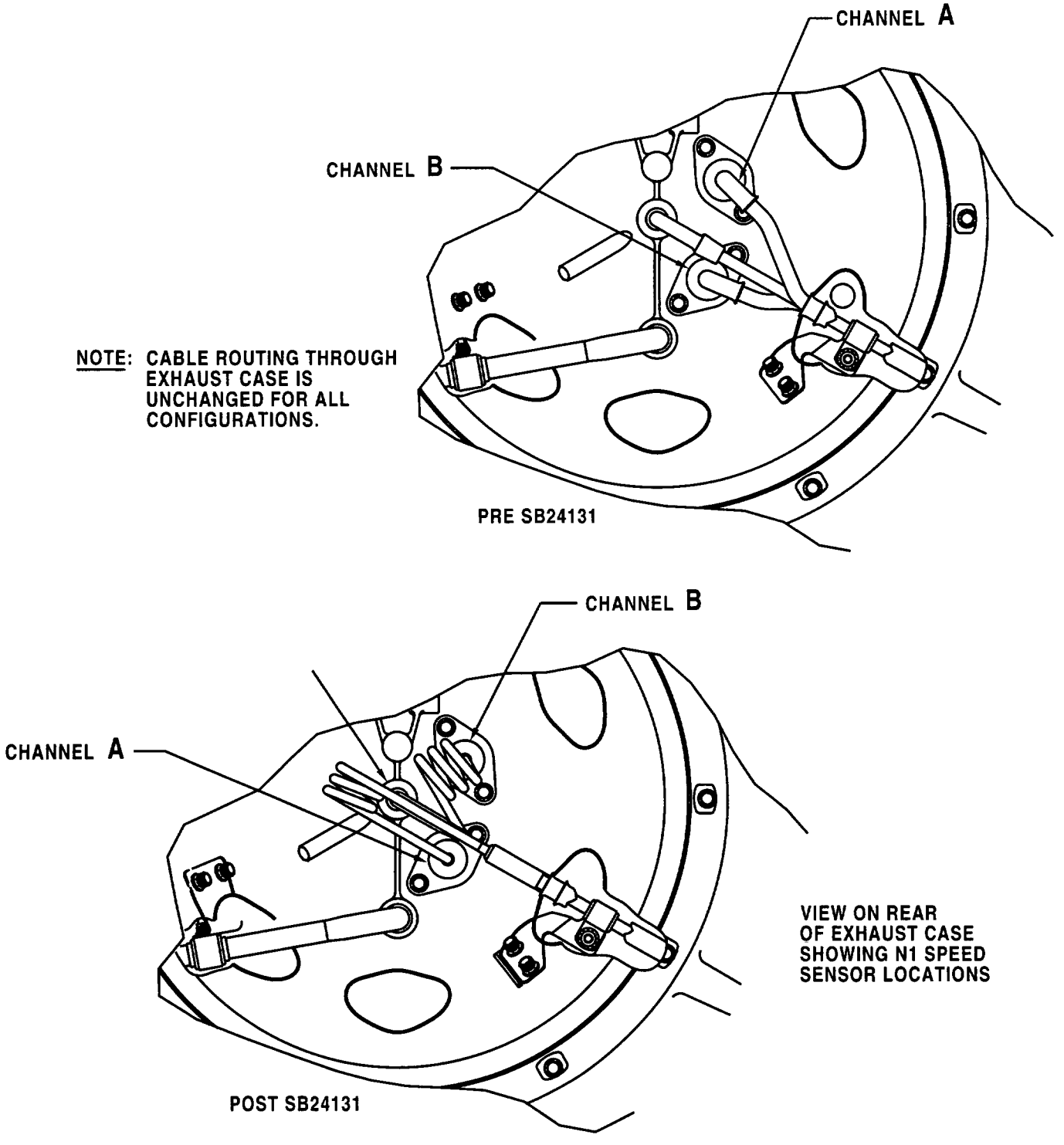
N1 Speed Sensors - SB24060, SB24037 - Removal/Installation
Figure 201 (Sheet 2)



POST-SB24037
VIEW A

C21358

N1 Speed Sensors - SB24060, SB24037 - Removal/Installation
Figure 201 (Sheet 3)



N1 Speed Sensors - SB24131 - Removal/Installation
Figure 202

(d) Remove 12 bolts (22, Sht. 2), cone shield (21) and exhaust cone (20).

(e) Pre-SB24037:

1 Remove two bolts (23, 25) and speed sensor (1). Discard preformed packing (24).

(f) Post-SB24037:

1 Remove three bolts (23, 26, 27, Sht. 3), one self-locking nut (28) and heat shield (29).

2 Remove bolt (25, Sht. 2) and speed sensor (2). Discard preformed packing (24).

(4) Channel B removal (Ref. Fig. 201):

(a) Remove bolt (13, Sht. 1), self-locking nut (12) and loop clamp (14).

NOTE: The locations of Channel A and B N1 sensors in the exhaust case are reversed for Post-SB24131 sensors (Ref. Fig. 202).

(b) Remove bolt (15, Fig. 201, Sht. 1), self-locking nut (17), loop clamp (16) and angle bracket (30, Pre-SB24060) or (31, Post-SB24060) (Ref. Fig. 201).

(c) Remove 12 bolts (22, Sheet 2), cone shield (21) and exhaust cone (20).

(d) Pre-SB24037:

1 Remove two bolts (19, 26) and speed sensor (1). Discard preformed packing (18).

(e) Post-SB24037:

1 Remove three bolts (23, 26, 27, Sht. 3), one self-locking nut (28) and heat shield (29).

2 Remove bolt (19, Sheet 2) and speed sensor (1). Discard preformed packings (18).

(5) Channel A and Channel B removal (Pre-SB24546) (Ref. Fig. 201 and 203):

(a) Remove two bolts (5), two self-locking nuts (2), three loop clamps (6) and bracket (10) (Ref. Fig .203).

(b) Remove bolts (1), self-locking nuts (2), loop clamps (4) that attaches N1 sensor cables to angle brackets (9).

(c) Remove loop clamps (4) and cable guide tubes (3) from the N1 cables (7 and 8).

(d) Remove 12 bolts (22), cone shield (21) and exhaust cone (20) (Ref. Fig. 201).

(e) Remove two bolts (19 and 26) and Channel B from the exhaust case. Remove and discard the preformed packing (18).

(f) Remove two bolts (23 and 25) and Channel A from the exhaust case. Remove and discard the preformed packing (24).

(6) Channel A and Channel B removal (Post-SB24546) (Ref. Fig. 203):

(a) Remove bolt (5), self-locking nut (2) and two loop clamps (6).

(b) Remove bolts (1), self-locking nuts (2), loop clamps (4) that attaches N1 sensor cables to angle brackets (9).

(c) Remove loop clamps (4) and cable guide tubes (3) from the N1 cables (7 and 8).

(d) Remove 12 bolts (22), cone shield (21) and exhaust cone (20) (Ref. Fig. 201).

(e) Remove two bolts (19 and 26) and Channel B from the exhaust case. Remove and discard the preformed packing (18).

NOTE: The locations of Channel A and B in the exhaust case are reversed for Post-SB24131 sensors (Ref. Fig. 202).

(f) Remove two bolts (23 and 25) and Channel A from the exhaust case. Remove and discard the preformed packing (24) (Ref. Fig. 201).

(7) Attach a piece of lockwire about five feet in length to the sheath of the speed sensor cable.

NOTE: The lockwire will be used to pull the replacement cable through the exhaust case.

(8) Carefully pull the cable through the conduit of the exhaust case.

B. Installation (Ref. Fig. 201)

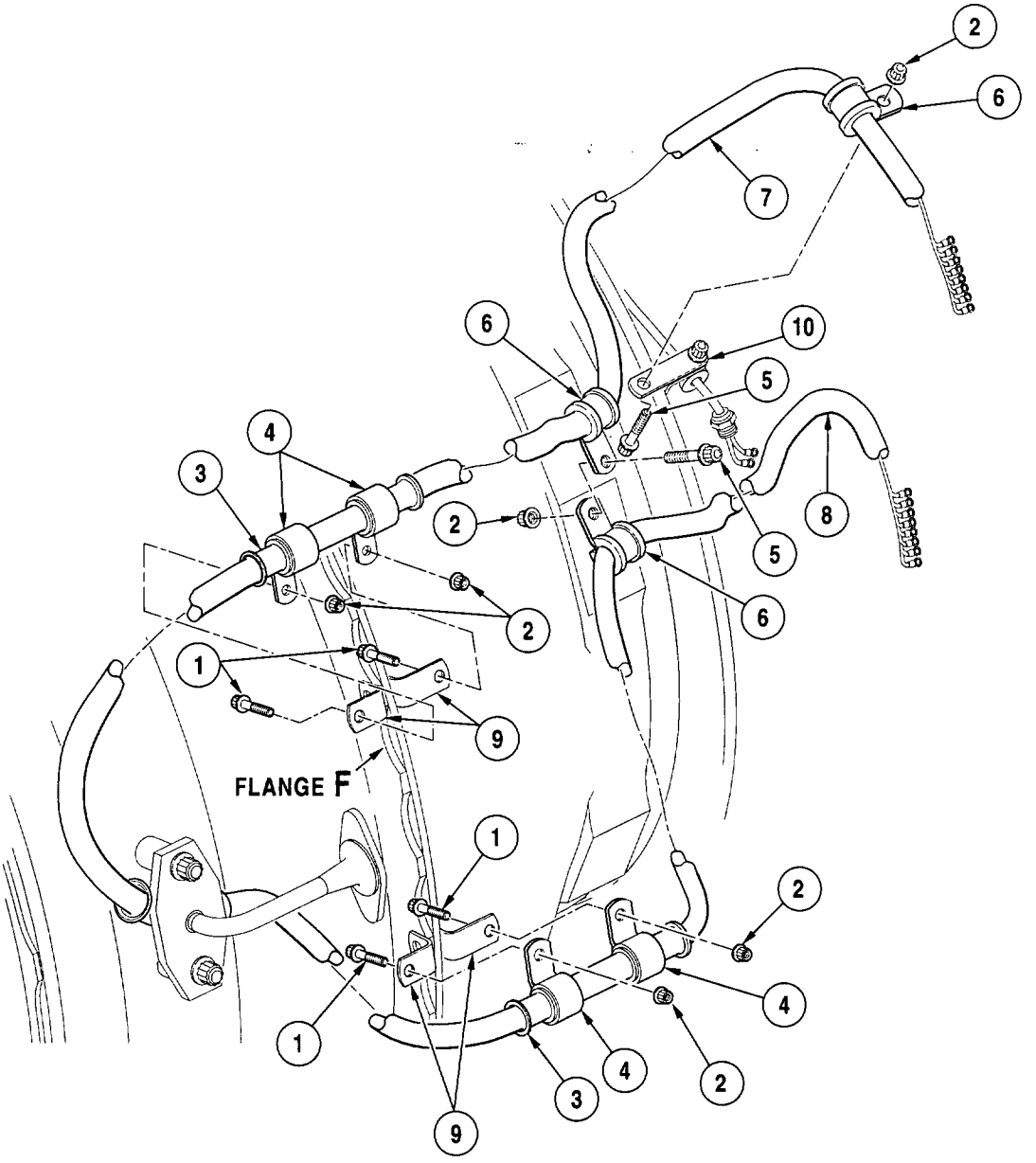
CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN REMOVING/INSTALLING CONNECTORS.

CAUTION: DO NOT PULL INDIVIDUAL WIRE CONNECTORS.

NOTE: The locations of Channel A and B N1 sensors in the exhaust case are reversed for Post-SB24131 sensors (Ref. Fig. 202).

CAUTION: DO NOT ATTACH LOCKWIRE TO WIRE CONNECTORS AS DAMAGE TO THE CABLE WILL RESULT.

(1) Attach lockwire used during removal to sheath of speed sensor cable.

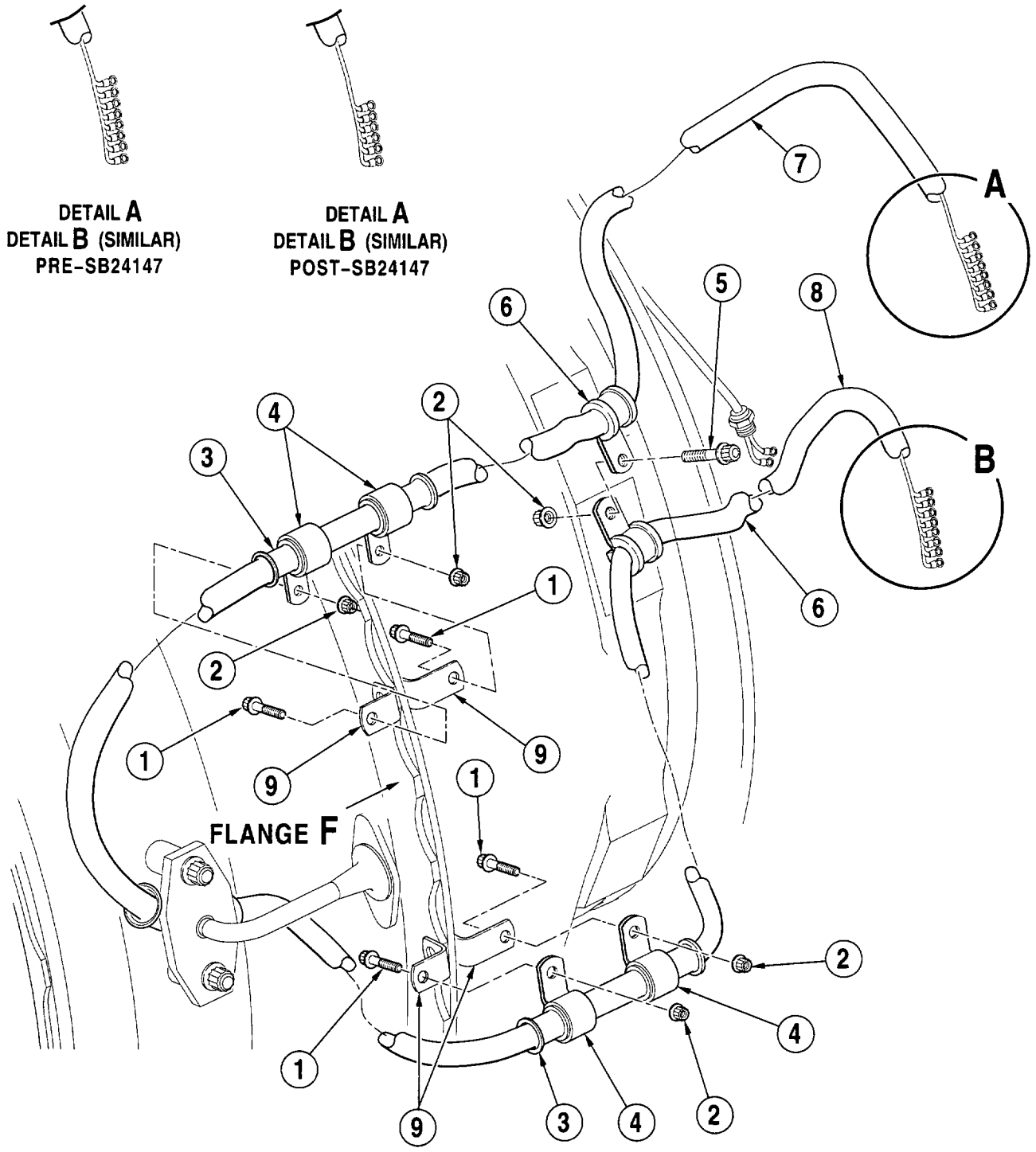


Pre-SB24546 C138540

N1 Speed Sensors - Removal/Installation
Figure 203 (Sheet 1 of 2)

Key to Figure 203

1. Bolt
2. Nut
3. Cable Guide Tube (Post-SB24122)
4. Loop Clamp (Post-SB24122)
5. Bolt
6. Loop Clamp (Post-SB24122)
7. N1 Speed Probe Cable - Channel A (Post-SB24546)
8. N1 Speed Probe Cable - Channel B (Post-SB24546)
9. Angle Bracket (Post-SB24122)
10. Bracket (Pre-SB24546)



Post-SB24122, Post-SB24546 C101229A

N1 Speed Sensors - Removal/Installation
Figure 203 (Sheet 2)

CAUTION: DO NOT PULL THE SPEED SENSOR CABLE WITH EXCESSIVE FORCE AS THIS MAY CAUSE BUNCHING OF THE CABLE SHEATH, RESULTING IN INTERNAL DAMAGE TO THE CABLE.

(2) Gently pull the sensor cable using lockwire, through the guide tube in the exhaust case. If sheath of cable begins to bunch, remove probe and start again.

(3) Channel A installation (Ref. Fig. 201):

(a) Install preformed packing (24, Sht. 2) on speed sensor (2) and install sensor in the exhaust case.

NOTE: The locations of Channel A and B N1 sensors in the exhaust case are reversed for Post-SB24131 sensors (Ref. Fig. 202).

(b) Pre-SB24037:

1 Apply anti-seize compound (PWC06-009) to bolts (23, 25, Fig. 201, Sht. 2) and secure speed sensor (2) to the exhaust duct. Torque bolts 27 to 30 lb.in. (3.0-3.4 Nm.).

(c) Post-SB24037:

1 Apply anti-seize compound (PWC06-009) to bolts (23, 25). Secure speed sensor (2) to the exhaust duct with bolt (25), fingertight. Install heat shield (29, Sht. 3) and secure shield and sensor with bolt (23, Sht. 2). Torque bolts (23, 25) 27 to 30 lb.in. (3.0-3.4 Nm.).

2 Apply anti-seize compound (PWC06-009) to bolt (27, Sht. 3), and secure heat shield (29) with bolt (27) and self-locking nut (28). Torque 27 to 30 lb.in. (3.0-3.4 Nm.).

(d) Install bolt (5, Sht. 1), loop clamp (4) and self-locking nut (3). Torque 27 to 30 lb.in. (3.0-3.4 Nm.).

(e) Install bolt (8), loop clamp (7) and self-locking nut (9). Torque 27 to 30 lb.in. (3.0-3.4 Nm.).

(f) Install bolt (11), loop clamp (10) and self-locking nut (9). Torque 27 to 30 lb.in. (3.0-3.4 Nm.).

(4) Channel B installation (Ref. Fig. 201):

(a) Install preformed packing (18, Sht. 2) on speed sensor (1) and install sensor in the exhaust case.

NOTE: The locations of Channel A and B N1 sensors in the exhaust case are reversed for Post-SB24131 sensors (Ref. Fig. 202).

(b) Pre-SB24037:

1 Apply anti-seize compound (PWC06-009) to bolts (19, 26, Fig. 201, Sht. 2) and secure speed sensor (1) to the exhaust duct. Torque bolts 27 to 30 lb.in. (3.0-3.4 Nm.).

(c) Post-SB24037:

1 Apply anti-seize compound (PWC06-009) to bolts (19, 26). Secure speed sensor (1) to the exhaust duct with bolt (19), fingertight. Install heat shield (29) and secure shield and sensor with bolt (26). Torque bolts (19, 26) 27 to 30 lb.in. (3.0-3.4 Nm.).

2 Apply anti-seize compound (PWC06-009) to bolt (27, Sht. 3), and secure heat shield (29) with bolt (27) and self-locking nut (28). Torque 27 to 30 lb.in. (3.0-3.4 Nm.).

(d) Install bolt (15), loop clamp (16), angle bracket (30, Pre-SB24060) or (31, Post-SB24060) and self-locking nut (17). Torque 27 to 30 lb.in. (3.0-3.4 Nm.).

(e) Install bolt (13), loop clamp (14) and self-locking nut (12). Torque 27 to 30 lb.in. (3.0-3.4 Nm.).

(5) Channel A and Channel B installation (Pre-SB24546) (Ref. Fig. 201 and 203):

(a) Install preformed packings (18 and 24) on speed sensors (1 and 2) and install sensors in the exhaust case (Ref. Fig. 201).

(b) Install cable guide tubes (3), loop clamps (4), bolts (1) and nuts (2) to attach sensor cables to brackets (9) (Ref. Fig. 203). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(c) Install bolt (5), clamps (6) and self-locking nut (2) to attach N1 speed sensor cables (7 and 8) to brackets (10). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(6) Channel A and Channel B installation (Post-SB24546) (Ref. Fig. 201 and 203):

CAUTION: DO NOT PULL, TWIST OR SHARPLY BEND INDIVIDUAL WIRE CONNECTOR LEADS.

CAUTION: DO NOT ATTACH LOCKWIRE TO THE WIRE CONNECTOR LEADS OR APPLY TAPE AROUND BUNDLED CONNECTOR LEADS, AS LEADS COULD BE EASILY DAMAGED.

(a) Install preformed packings (18 and 24) on speed sensors (1 and 2) and install sensors in the exhaust case (Ref. Fig. 201).

NOTE: The locations of Channel A and B N1 sensors in the exhaust case are reversed for Post-SB24131 sensors (Ref. Fig. 202).

1 Pre-SB24037:

a Apply anti-seize compound (PWC06-009) to bolts (19, 26 and 23, 25, Fig. 201) and attach speed sensors to the exhaust duct. Torque bolts 27 to 30 lb.in. (3.0-3.4 Nm).

2 Post-SB24037:

a Apply anti-seize compound (PWC06-009) to bolts (19, 26 and 23, 25). Attach Channel B and Channel A sensors to the exhaust duct with bolts (19 and 25), tighten with fingers. Install heat shield (29) and attach the shield and sensors with bolts (23 and 26). Torque bolts (19, 26 and 23, 25) 27 to 30 lb.in. (3.0-3.4 Nm).

b Apply anti-seize compound (PWC06-009) to bolt (27), and attach heat shield (29) with bolt (27) and self-locking nut (28). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

3 Install cable guide tubes (3), loop clamps (4), bolts (1) and nuts (2) to attach sensor cables to brackets (9) (Ref. Fig. 203). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

4 Install bolt (5), clamps (6) and self-locking nut (2) to attach N1 speed sensor cables (7 and 8) in place. Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(7) Connect N1 speed sensor cables to N1/T4.5 terminal box (Ref. Ch. 77-20-01, T4.5 THERMOCOUPLES - MAINTENANCE PRACTICES).

(8) Do a continuity check of the coils and make sure the resistance values are as follows:

(a) Pre-SB24546:

Coil No.	Resistance Value (Ohms)
1. Yellow and orange leads	1100 to 1600
2. White and brown leads	730 to 1100
3. Red and blue leads	570 to 840

(b) Post-SB24546:

Coil No.	Resistance Value (Ohms)
1. Yellow and orange leads	125 to 200
2. White and brown leads	125 to 200
3. Red and blue leads	125 to 200

(9) Install bolts, cone shield and exhaust cone (Ref. Ch. 72-50-03, EXHAUST CASE - REMOVAL/INSTALLATION).

(10) Restore electrical power to appropriate system and reset EEC circuit breaker ON.

(11) Select maintenance test discrete OFF.

(12) Pull EEC circuit breaker to OFF.

6. N2 Speed Sensors

CAUTION: MAKE SURE AIRFRAME ELECTRICAL POWER IS OFF WHEN REMOVING/INSTALLING CONNECTORS.

A. Channel A - Removal (Ref. Fig. 204)

(1) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).

(2) Drain oil from accessory gearbox (2) (Ref. 72-00-00, SERVICING).

(3) Disconnect outer wiring harness connector P9 (7).

(4) Remove two bolts (6) and washers (5).

(5) Remove speed sensor (4) and discard preformed packing (3).

B. Channel A - Installation (Ref. Fig. 204)

(1) Install new preformed packing (3) on speed sensor (4).

(2) Insert speed sensor (4) into boss in accessory gearbox (2) with two bolts (6) and washers (5). Tighten bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(3) Apply electrical contact enhancer to connectors (Ref. Chapter 70-00-00, CLEANING).

CAUTION: TIGHTEN CONNECTORS WITH APPROVED TOOL ONLY . CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY THE BLUE COLOR BAND IS VISIBLE

(4) Connect outer wiring harness connector P9 (7) to N2 speed sensor (4). Torque connector 30 to 35 lb.in. (3.4-4.0 Nm) using wrench (PWC60142-100).

(5) Install accessory gearbox drain plug (Ref. Chapter 72-00-00, SERVICING), and service as required.

(6) Restore electrical power to appropriate system and reset EEC circuit breaker ON.

(7) Select maintenance test discrete OFF.

(8) Pull EEC circuit breaker to OFF.

C. Channel B - Removal (Ref. Fig. 204)

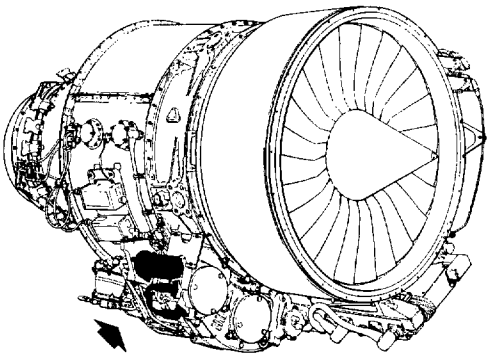
(1) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).

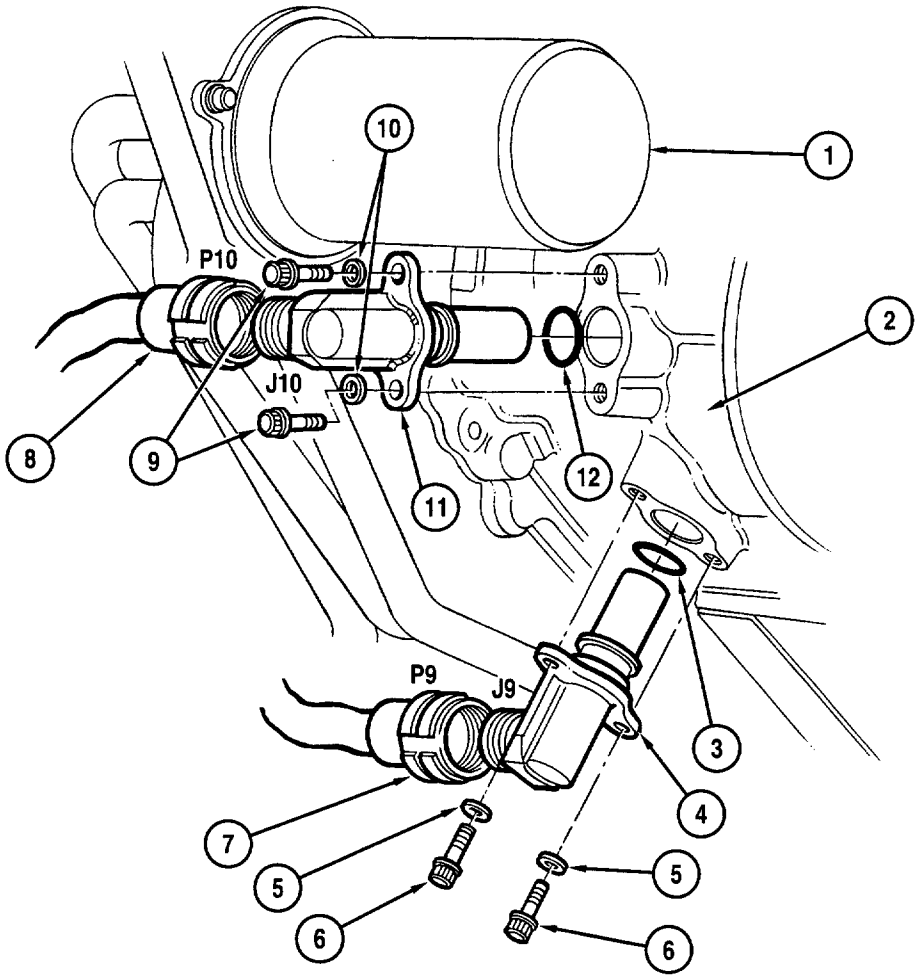
(2) Drain oil from accessory gearbox (2) (Ref. 72-00-00, SERVICING).

(3) Disconnect outer wiring harness connector P10 (8).

(4) Remove two bolts (9) washer (10) loop clamp (13).

(5) Remove speed sensor (11) and discard preformed packing (12).





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N2 Speed Sensors - Removal/Installation
Figure 204

Key to Figure 204

1. Fuel Filter (Ref.)
2. Accessory Gearbox (Ref.)
3. Preformed Packing
4. N2 Speed Sensor (Channel A)
5. Washer
6. Bolt
7. Wiring Harness Connector-P9 (Channel A)
8. Wiring Harness Connector-P10 (Channel B)
9. Bolt
10. Washer
11. N2 Speed Sensor (Channel B)
12. Preformed Packing
13 Loop Clamp

D. Channel B - Installation (Ref. Fig. 204)

(1) Install new preformed packing (12) on speed sensor (11).

(2) Insert speed sensor (11) into boss in accessory gearbox (2) and secure with two bolts (9) washer (10) and loop clamp (13). Tighten and torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(3) Apply electrical contact enhancer to connectors (Ref. 70-00-00, CLEANING).

CAUTION: USE ONLY APPROVED TOOLS TO TIGHTEN WIRING HARNESS CONNECTORS. CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY THE BLUE COLOR BAND IS VISIBLE; RED COLOR BAND MUST NOT BE VISIBLE.

(4) Connect external wiring harness connector P10 (8) to N2 speed sensor (11). Torque connector 30 to 35 lb.in. (3.4-4.0 Nm) using wrench (PWC60142-100).

(5) Install accessory gearbox drain plug(Ref. 72-00-00, SERVICING), and service as required.

(6) Restore electrical power to appropriate system and reset EEC circuit breaker ON.

(7) Select maintenance test discrete OFF.

(8) Pull EEC circuit breaker to OFF.

TABLE OF CONTENTS

SUBJECT	PAGE
T4.5 THERMOCOUPLES - MAINTENANCE PRACTICES	**77-20-01**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. N1/T45 Terminal Box	202
A. Removal	202
B. Installation	202
6. T4.5 Thermocouple Wiring Harness	206
A. Removal	206
B. Installation	210
7. T4.5 Terminal Block	211
A. Removal	211
B. Installation	211
8. Inspection/Check	211
A. Procedure	211
9. Adjustment/Test	212
A. Test T4.5 System	212
P1/T1 SENSORS - MAINTENANCE PRACTICES	**77-20-02**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. P1/T1 Sensors and P1 Air Pressure Tube (Pre-SB24198)	201
A. Removal	201
B. Installation	203

TABLE OF CONTENTS

SUBJECT	PAGE
P1/T1 SENSORS - MAINTENANCE PRACTICES (Cont'd)	**77-20-02**
6. P1/T1 Sensors and P1 Air Pressure Tube (Post-SB24198 (PW305A only)/Pre-SB24420)	205
A. Removal	205
B. Installation	205
7. P1/T1 Sensors and P1 Air Pressure Tube (Post-SB24420 (PW305A and PW305B)/Pre-SB24434/Post-SB24514)	208
A. Removal	208
B. Installation	209
8. P1/T1 Sensors and P1 Air Pressure Tube (Post-SB24434/Pre-SB24514)	211
A. Removal	211
B. Installation	213

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	May 30/2008
	2 blank	May 30/2008
Contents	1	May 30/2008
	2	May 30/2008
77-20-01 Maintenance Practices	201	May 30/2008
	202	May 30/2008
	203	May 30/2008
	204	May 30/2008
	205	May 30/2008
	206	May 30/2008
	207	May 30/2008
	208	May 30/2008
	209	May 30/2008
	210	May 30/2008
	211	May 30/2008
	212	May 30/2008
77-20-02 Maintenance Practices	201	Feb 15/2008
	202	Feb 15/2008
	203	Feb 15/2008
	204	Feb 15/2008
	205	Feb 15/2008
	206	Feb 15/2008
	207	Feb 15/2008
	208	Feb 15/2008
	209	Feb 15/2008
	210	Feb 15/2008
	211	Feb 15/2008
	212	Feb 15/2008
	213	Feb 15/2008
	214	Feb 15/2008
	215	Feb 15/2008
	216	Feb 15/2008
	217 deleted	
	218 deleted	

T4.5 THERMOCOUPLES - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternative products, suppliers and suppliers addresses.

Item No.	Name
PWC05-089	Lockwire
PWC06-009	Compound, Anti-seize
PWC06-036	Compound, Lubricating

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   The fixtures, equipment and supplier tools listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Name	Remarks
Barfield Test Set	Model TT-1000A

5. N1/T45 Terminal Box

CAUTION: ENSURE AIRFRAME ELECTRICAL POWER IS OFF WHEN HANDLING RECEPTACLES AND PLUGS.

CAUTION: ENSURE PLUGS AND RECEPTACLES ARE FREE OF MOISTURE; IF NECESSARY, DRY USING HEAT GUN.

CAUTION: DO NOT FORCE OR STRETCH HARNESS WHEN INSTALLING CONNECTORS OR SECURING SELF-LOCKING LOOP CLAMPS.

CAUTION: USE ONLY APPROVED TOOLS TO TIGHTEN WIRING HARNESS CONNECTORS. CONNECTORS ARE PROPERLY TIGHTENED WHEN ONLY BLUE COLOR BAND IS VISIBLE; RED COLOR BAND MUST NOT BE VISIBLE.

A. Removal (Ref. Fig. 201)

(1) Remove four self-locking nuts (12) and terminal box cover (13).

(2) Remove self-locking nuts alumel (21) and chromel (20) and remove T4.5 wire connections from terminal block (23).

(3) Remove lockwire and unscrew "T4.5 OUT" harness connector (15) from terminal box (19).

(4) Remove lockwire and unscrew "T4.5 IN" harness connectors (1) and (16) from terminal box (19).

(5) Remove washers (7, 14) (Pre-SB24050) from "T4.5 IN" harness connectors (1, 16).

NOTE: Washers not required on Post-SB24050 T4.5 wiring harness.

(6) Remove 16 self-locking nuts (22) from bus-bars (24) and remove wire connections.

(7) Remove lockwire and unscrew "N1 OUT" harness connectors (17 and 18) from terminal box (19).

(8) Remove self-locking nut (8), bolt (11) and bracket (9) from terminal box (19).

(9) Withdraw "N1 IN" cables (2 and 3) from terminal box (19).

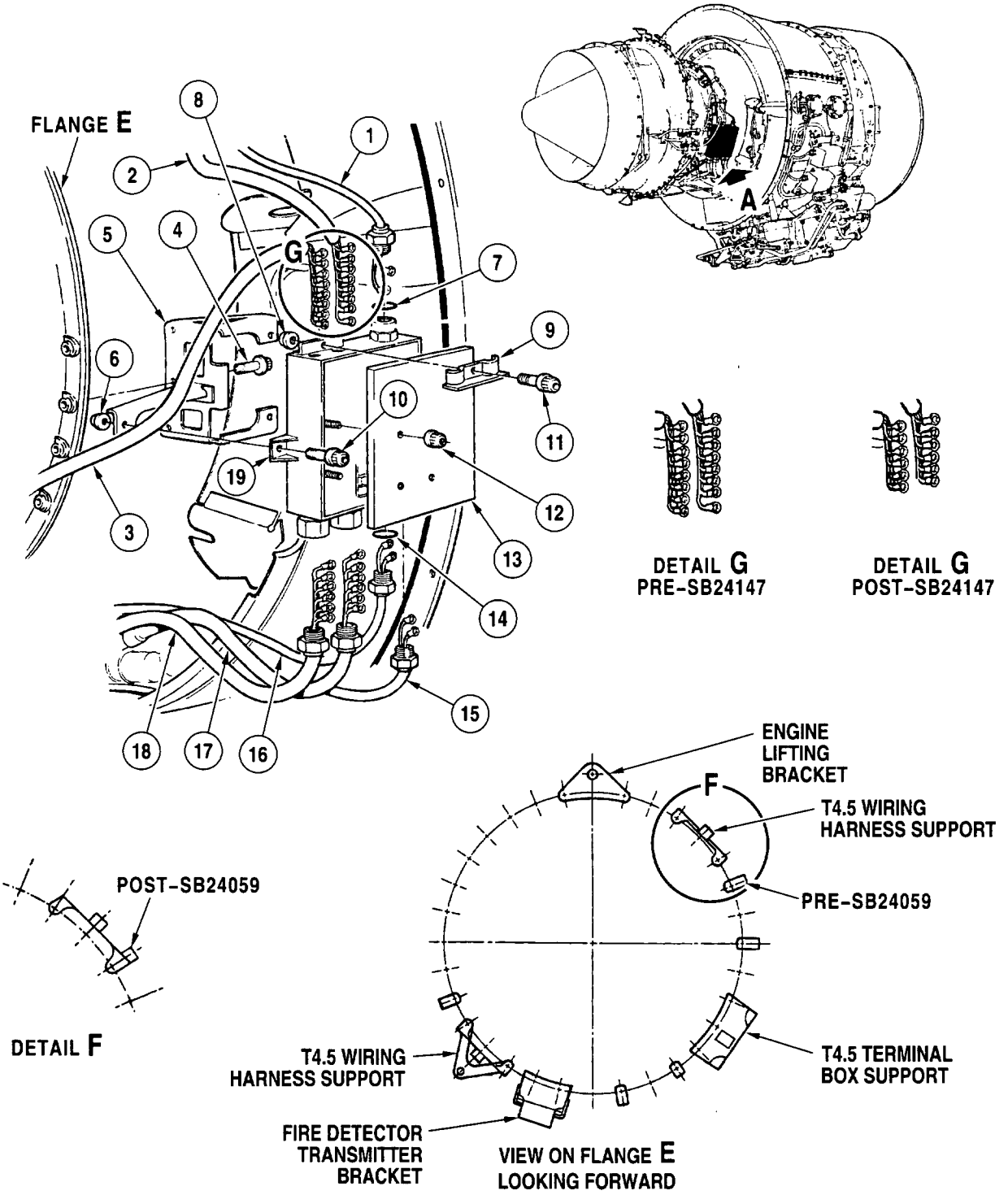
(10) Remove three self-locking nuts (6), three bolts (10) and remove terminal box from support (5).

(11) Remove three bolts (4) and terminal box support (5) from Flange E.

B. Installation (Ref. Fig. 201)

(1) Secure terminal box support (5) on Flange E with three bolts (4). Torque 85 to 95 lb.in. (9.5-11.0 Nm).

(2) Install terminal box (19) on terminal support (5) with three self-locking nuts (6) and bolts (10). Torque 36 to 40 lb.in. (4.0-4.6 Nm).



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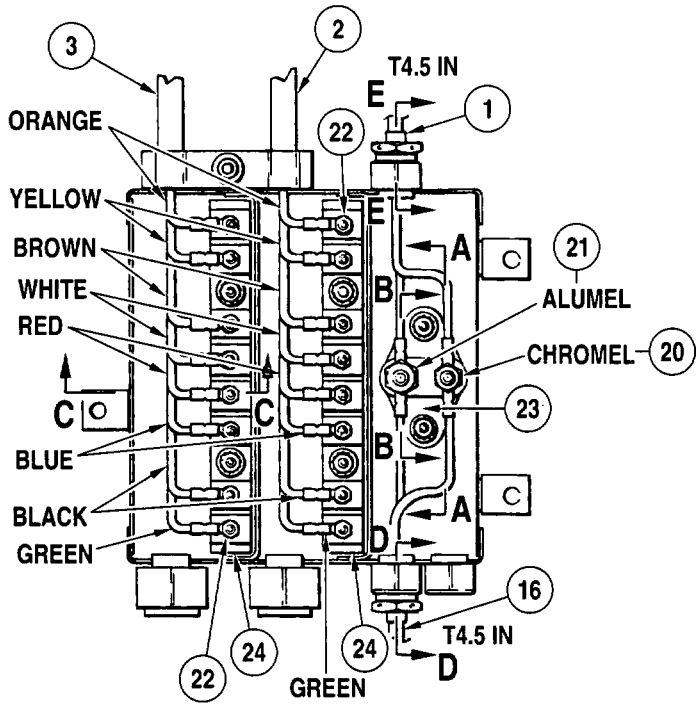
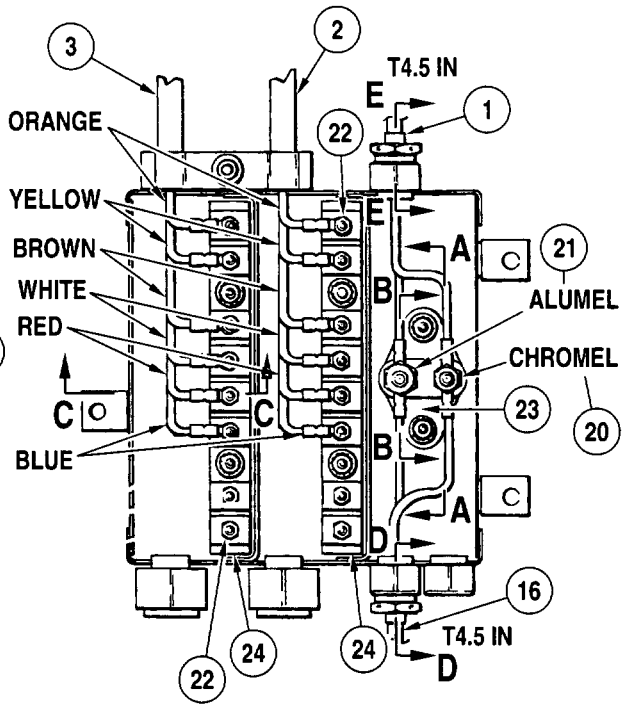
N1/T45 Terminal Box - Removal/Installation
Figure 201 (Sheet 1 of 2)

Key to Figure 201

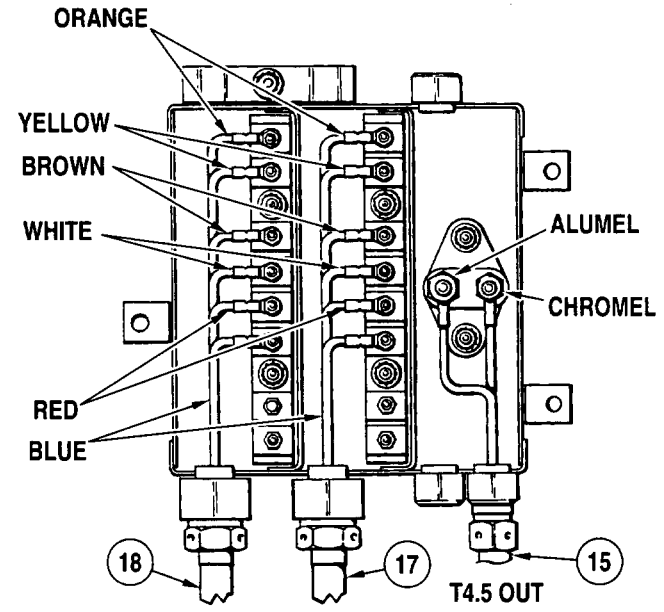
1. T4.5 in
2. N1 in (CH. A)
3. N1 in (CH. B)
4. Bolt
5. Terminal Box Support
6. Self-locking Nut
7. Washer Pre-SB24050
8. Self-locking Nut
9. Bracket
10. Bolt
11. Bolt
12. Self-locking Nut
13. Cover (part of terminal box)
14. Washer Pre-SB24050
15. T4.5 out (part of rear core wiring harness)
16. T4.5 in
17. N1 out (CH. A, part of rear core wiring harness)
18. N1 out (CH. B, part of rear core wiring harness)
19. Terminal Box
20. Self-locking Nut (Chromel)
21. Self-locking Nut (Alumel)
22. Self-locking Nut
23. Terminal Block (T45)
24. Bus-bar (N1)



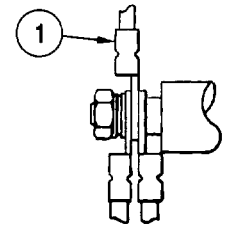
VIEW **A** (COVER REMOVED)
PRE-SB24147



VIEW **A** (COVER REMOVED)
POST-SB24147

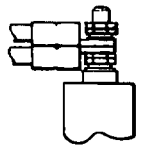


VIEW **A** (REPEAT)
(COVER REMOVED)

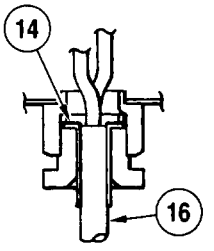


ORIGINAL
As Received By
ATP

SECTION **A-A**
SECTION **B-B** (SIMILAR)



SECTION **C-C**



SECTION **D-D**
SECTION **E-E** (SIMILAR)

C19745D

N1/T45 Terminal Box - Removal/Installation
Figure 201 (Sheet 2)

(3) Insert "N1 OUT CH. B" harness (18) into terminal box (19). Torque harness coupling nut 45 to 55 lb.in. (5.0-5.5 Nm).

(4) Insert "N1 OUT CH. A" harness (17) into terminal box (19). Torque harness coupling nut 45 to 55 lb.in. (5.0-5.5 Nm).

(5) Lockwire (PWC05-089) coupling nuts on harness (17 and 18).

(6) Locate N1 wire connections on bus bar (24). Refer to View A for color coding.

(7) Insert N1 cables (2 and 3) into terminal box (19) and secure with bracket (9) and self-locking nut (8). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(8) Locate wire connections on bus-bar (24). Refer to View A for color coding. Torque post nuts (22) 3.5 to 4 lb.in. (0.3 - 0.4 Nm).

(9) Install washers (7, 14) (Pre-SB24050) on "T4.5 IN" cables (1, 16) and install in terminal box (19). Torque coupling nuts 15 to 25 lb.in. (1.6-2.8 Nm) and lockwire (PWC05-089).

NOTE: Washers not required on Post-SB24050 T4.5 wiring harness.

(10) Install "T4.5 OUT" cable (15) in terminal box (19). Torque 15 to 25 lb.in. (1.6-2.8 Nm).

(11) Fit T4.5 wire connections on terminal block (23) with self-locking nuts; chromel (20) and alumel (21). Refer to View A for correct location.

(12) Install large alumel nut (21) and torque 24 to 40 lb. in. (2.8-4.6 Nm).

(13) Install small chromel nut (20) and torque 15 to 20 lb.in. (1.6-2.8 Nm).

(14) Lockwire (PWC05-089) coupling nuts (15 and 16).

(15) Secure terminal box cover (13) with four self-locking nuts (12). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

6. T4.5 Thermocouple Wiring Harness

A. Removal (Ref. Fig. 202)

(1) Set maintenance test discrete to ON before wiring harness removal (Ref. Aircraft Maintenance Manual).

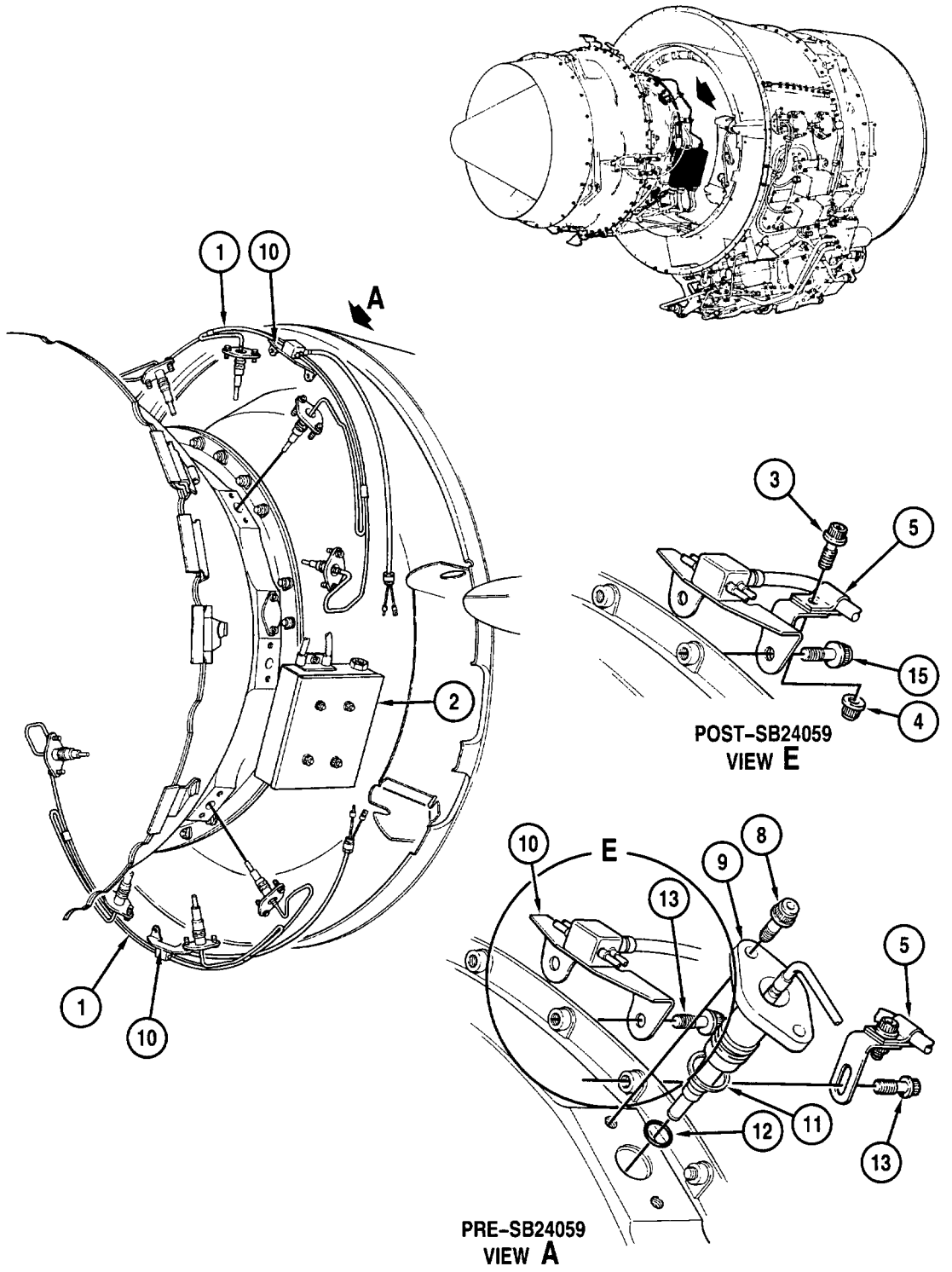
(2) Disconnect T4.5 wiring harness from N1/T4.5 terminal box.

(3) Remove four nuts (4), bolts (3) and loop clamp (5).

(4) Remove two bolts (6) and bracket (7) (Pre-SB24012) or bracket (14) (Post-SB24012).

(5) Pre-SB24059 - Remove four bolts (13).

(6) Post-SB24059 - Remove three bolts (13), bolt (14) and bracket (15).

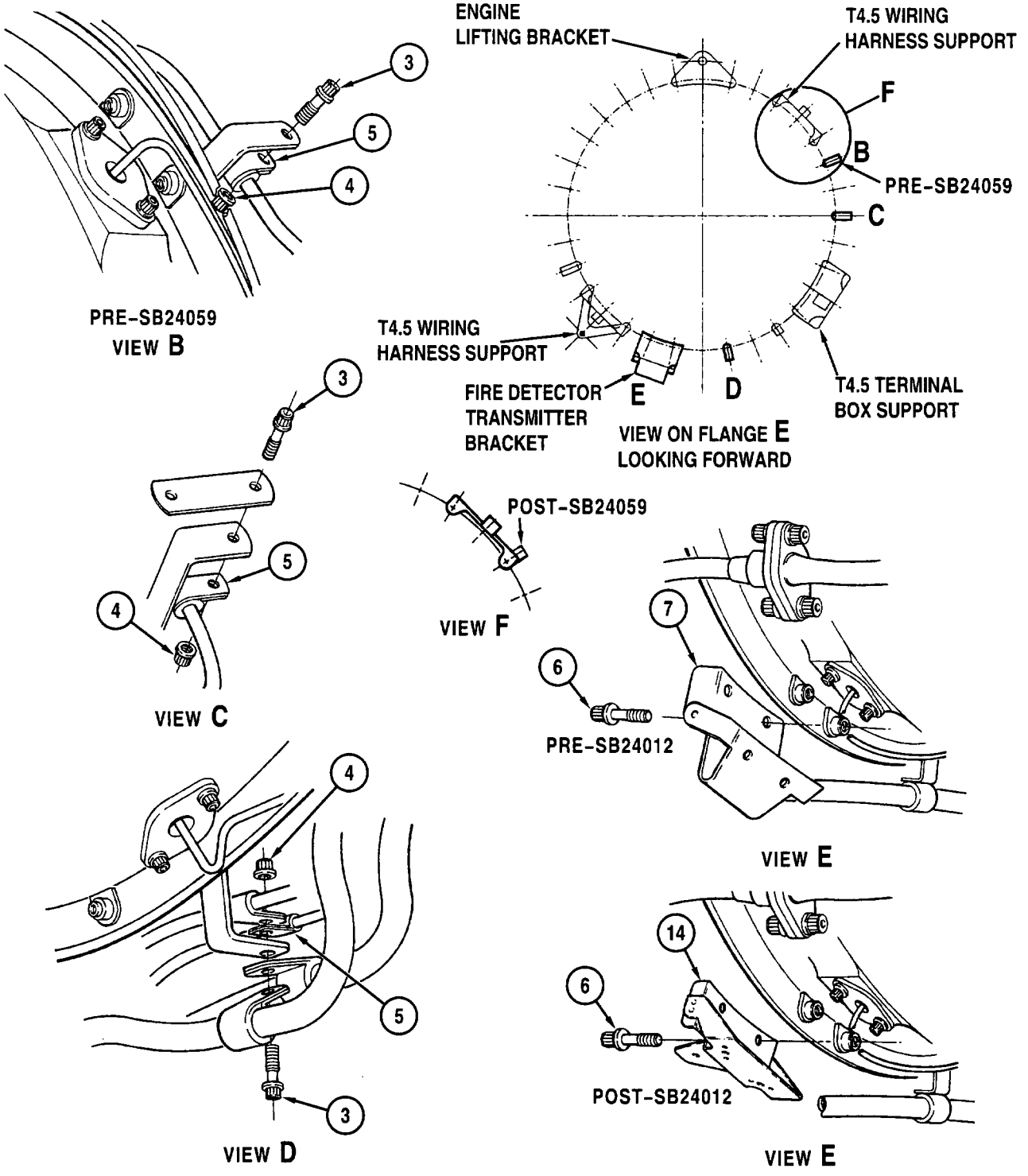


C19706C

T4.5 Thermocouple Wiring Harness - Removal/Installation
Figure 202 (Sheet 1 of 2)

Key to Figure 202

1. T4.5 Thermocouple Wiring Harness
2. N1/T4.5 Terminal Box
3. Bolt
4. Self-locking Nut
5. Loop Clamp
6. Bolt
7. Fire Detector Transmitter Bracket (Pre-SB24012)
8. Bolt
9. T4.5 Probe (part of wiring harness)
10. Support Bracket (part of wiring harness)
11. Gasket
12. Ring-seal
13. Bolt
14. Fire Detector Transmitter Bracket (Post-SB24012)
15. Bolt (Post-SB24012)



C19705C

T4.5 Thermocouple Wiring Harness - Removal/Installation
Figure 202 (Sheet 2)

(7) Remove 16 bolts (8) that attach T4.5 probes in LP turbine case.

(8) Carefully remove two wiring harnesses (1) from engine. Discard eight ring-seals (12) and gasket (11).

B. Installation (Ref. Fig. 202)

(1) Apply a light coat of anti-seize compound (PWC06-009) to eight new ring-seals (12) and position on T4.5 probes (9).

CAUTION: ENSURE RING-SEALS (12) AND GASKET (11) ARE NOT DAMAGED DURING INSTALLATION.

(2) Position eight new gaskets (11) on T4.5 probes and carefully insert probes into their respective bosses on LP turbine case.

(3) Pre-SB24559 (PW305A and PW305B): Apply a light coat of lubricating compound (PWC06-036) to 16 bolts (8) and attach T4.5 probes to LP turbine case. Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(4) Post-SB24559 (PW305A and PW305B): Apply a light coat of anti-seize compound (PWC06-009) to 16 bolts (8) and attach T4.5 probes to LP turbine case. Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(5) Pre-SB24059: Attach two brackets (10) to Flange E with bolts (13). Torque 85 to 95 lb.in. (9.5-11 Nm).

(6) Post-SB24059: Attach bracket (10) at 8 o'clock position with two bolts (13). Install other bracket (10) and bracket (15) at 2 o'clock position, and attach with bolt (13) and bolt (14). Torque 85 to 95 lb.in. (9.5-11 Nm).

(7) Install bracket (7) (Pre-SB24012) or (14) (Post-SB24012) with two bolts (6). Torque 85 to 95 lb.in. (9.5-11 Nm).

(8) Install four loop clamps (5) bolts (3) and self-locking nuts (4). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(9) Connect T4.5 wiring harness flexible leads to N1/T4.5 terminal box.

(10) Restore electrical power to applicable system and reset EEC circuit breaker ON.

(11) Set maintenance test discrete to OFF after wiring harness installation and before engine operations (Ref. Aircraft Maintenance Manual).

(12) Refer to Chapter 71-00-00 for checks following installation of T4.5 thermocouple wiring harness.

(13) Pull EEC circuit breaker to OFF.

7. T4.5 Terminal Block

A. Removal (Ref. Fig. 201)

(1) Remove chromel and alumel nuts (20 and 21).

(2) Remove T4.5 IN and OUT wires from terminal block (23).

(3) Remove bolts, nuts, and terminal block (23) from terminal box (19).

B. Installation (Ref. Fig. 201)

(1) Install terminal block (23) inside terminal box (19) with bolts, bolt heads outside box, and nuts.

(2) Torque nuts 32 to 36 lb. in.

(3) Fit T4.5 IN and OUT wires on terminal block (23). Refer to View A for correct location.

(4) Install large alumel nut (21) and torque 24 to 40 lb. in. (2.8-4.6 Nm).

(5) Install small chromel nut (20) and torque 15 to 20 lb.in. (1.6-2.8 Nm).

(6) Check function of T4.5 system (Ref. Para. 9. A.).

8. Inspection/Check

A. Procedure

(1) Testing information transferred to ADJUSTMENT/TEST.

(2) Inspect wiring as follows:

(a) Check insulation and wires for cracks or chafing. Reject if cracks are found or if wires are exposed or damaged.

(b) Check terminal lugs for looseness or cracks. Reject if found.

(c) If harness is rejected, return to P&WC for evaluation and possible repair.

(3) Inspect metal tubing as follows:

(a) Check for nicks, dents, scores or scratches. Reject if core is exposed.

(b) Check for cracks. Reject if found.

(c) Check for deformation. Reject if kinked or if sharp bend radii exist.

(4) Check connector threads for damage. Chase threads using a 0.500-20UNJF 3A die.

(5) Inspect thermocouple probes as follows:

(a) Check for pitting and erosion. Reject if core is exposed.

(b) Check for cracks. Reject if found.

(c) Check for deformation. Reject if found.

(6) Information transferred to ADJUSTMENT/TEST.

9. Adjustment/Test

A. Test T4.5 System

(1) Check continuity resistance between terminal lugs:

(a) Pre-SB24390: Resistance to be 1.84 ± 0.2 ohms at 72°F ± 10°.

(b) Post-SB24390: Resistance to be 2.17 ± 0.2 ohms at 72°F ± 10°.

(2) Check function of thermocouples as follows:

(a) Connect the negative lead from a DC millivolt meter to the Alumel terminal lug (shortest lead out) and the positive lead to the Chromel terminal lug (longest lead out).

(b) Heat each thermocouple probe separately using a suitable heat gun, until a positive indication on the volt meter is observed.

P1/T1 SENSORS - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-089	Lockwire
PWC05-105	Tape, Electrical Insulating
PWC06-009	Compound, Anti-seize

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC58104	Strap Wrench
PWC60142-100	Wrench

4. Fixtures, Equipment and Supplier Tools

   The fixtures, equipment and supplier tools listed below are used in the following procedures.

Name
Pliers, Glenair TG69
Pliers, Glenair TG70

5. P1/T1 Sensors and P1 Air Pressure Tube (Pre-SB24198)

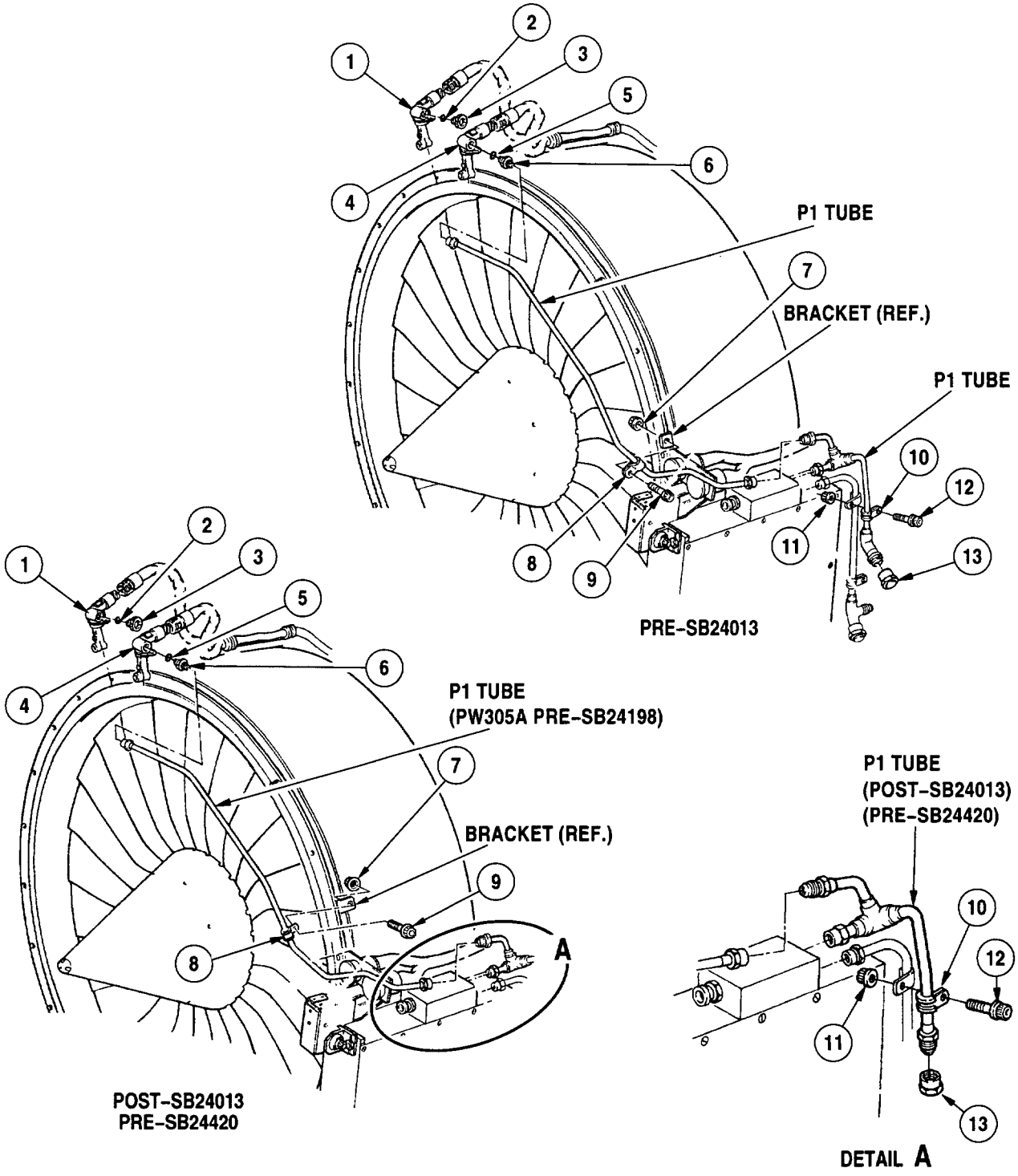
   A. Removal (Ref. Fig. 201)

      (1) Set maintenance test discrete to ON (Ref. Aircraft Maintenance Manual).

      (2) Remove electrical connectors P22 and P23 from P1/T1 sensors (1 and 4).

      (3) Disconnect upper coupling nut attaching P1 tube to P1/T1 sensor (4).

      (4) Remove P1/T1 sensors (1 and 4) from inlet cowling (Ref. Aircraft Maintenance Manual).



P1/T1 Sensors and P1 Air Pressure Tubes - Removal/Installation
Figure 201

Key to Figure 201

1. P1/T1 Sensor
2. Preformed Packing
3. Plug
4. P1/T1 Sensor
5. Preformed Packing
6. Reducer
7. Self-locking Nut
8. Loop Clamp
9. Bolt
10. Loop Clamp
11. Self-locking Nut
12. Bolt
13. Cap

(5) If P1/T1 sensor(s) (1 and/or 4) are/is being replaced, remove reducer (6) and/or plug (3) as necessary.

(6) Remove and discard preformed packing(s) (2 and/or 5).

(7) Remove main P1 tube from inlet cowling (Ref. Aircraft Maintenance Manual).

(8) Disconnect lower coupling nut that attaches main P1 tube to tube.

(9) Remove nut (7), bolt (9), loop clamp (8) and P1 tube from adjacent bracket on flange.

(10) Disconnect tube from pressure transducer.

(11) Remove nut (11), bolt (12), loop clamp (10) and lower P1 tube.

(12) If lower P1 tube is being replaced, remove cap (13).

B. Installation (Ref. Figs. 201 and 205)

(1) Apply anti-seize compound (PWC06-009) to tube (10, Fig. 201) end fittings, including ferrule nut seating shoulder.

(2) Install lower P1 tube to EEC. Tighten coupling nut with your fingers.

(3) Install loop clamp (10) on lower P1 tube and attach to bracket on P3 tube with bolt (12) and nut (11). Torque nut to 36 to 40 lb. in. (4.0-4.6 Nm).

(4) If removed, install cap (13) on lower P1 tube.

(5) Torque cap 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(6) Install P1/T1 sensors (Ref. Aircraft Maintenance Manual).

(7) Install new preformed packings (2 and 5) on plug (3) and reducer (6) respectively.

(8) If removed, install plug (3) and/or reducer (6) into P1/T1 sensors (1 and/or 4).

(9) Torque plug and/or reducer 40 to 50 lb.in. (4.6-5.5 Nm) and install lockwire (PWC05-089).

(10) Install P1/T1 sensors to inlet cowling (Ref. Aircraft Maintenance Manual).

(11) Apply anti-seize compound (PWC06-009) to lower P1 tube end fittings including shoulder of ferrule nut.

(12) Install main P1 tube between reducer (6) of P1/T1 sensor (4) and lower P1 tube. Tighten connectors with your fingers.

(13) Torque coupling nut of tube to EEC fitting 70 to 80 lb.in. (7.9-9.0 Nm).

(14) Torque coupling nuts at two ends of main P1 tube 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(15) Apply electrical contact enhancer to connectors (Ref. Chapter 70-00-00, CLEANING).

(16) Attach connectors P22 and P23 to P1/T1 sensors (1 and 4). Tighten each connector nut by hand until witness band on the mating receptacle is covered. It is recommended to further torque connector coupling nuts, with one of the following methods:

(a) Torque connectors 24 to 29 lb.in. (2.7 - 3.3 N.m) with wrench (PWC60142-100).

CAUTION: MINI-STRAP WRENCH HAS A DESIGN SLIP TORQUE OF 100 LB.IN. (11.3 Nm).

(b) Torque connectors with a mini-strap wrench (PWC58104) or Glenair TG70. Apply reasonable force to make sure connector coupling nut is firmly tightened.

CAUTION: SOFT JAWED PLIERS HAVE A DESIGN SLIP TORQUE OF 100 LB.IN. (11.3 Nm). DO NOT USE STEEL-JAWED PLIERS TO TIGHTEN CONNECTORS.

(c) Torque connectors with soft-jawed pliers Glenair TG69 or a similar tool. Apply reasonable force to make sure connector coupling nut is firmly tightened.

(17) Post-SB24473: Apply electrical insulation tape (PWC05-105) from the body of the receptacle to the backshell of the wiring harness connector as shown (Ref. Fig. 205). The tape must be stretched during this application and remain tight.

NOTE: Use of insulating tape to wrap electrical connectors is optional.

(18) Set maintenance test discrete to OFF (Ref. Aircraft Maintenance Manual).

(19) Pull EEC circuit breaker to OFF (Ref. Aircraft Maintenance Manual).

6. P1/T1 Sensors and P1 Air Pressure Tube (Post-SB24198 (PW305A only)/Pre-SB24420)

A. Removal (Ref. Fig. 202)

(1) Set maintenance test discrete to ON (Ref. Aircraft Maintenance Manual).

(2) Remove electrical connectors P22 and P23 from sensors (1 and 3). Check connectors for moisture. If necessary, dry connectors with suitable heat gun.

(3) If applicable, disconnect coupling nut of Post-SB24198 tube (4) from P1/T1 sensor (1) and from tee of main P1 tube.

(4) Remove P1/T1 sensors (1 and 3) from inlet cowling (Ref. Aircraft Maintenance Manual).

(5) Post-SB24339 (PW305A only): If P1/T1 sensor is being replaced, remove cap (2).

(6) Disconnect remaining coupling nut attaching main P1 tube to lower P1 tube (9).

(7) Remove nut (6), bolt (8), loop clamp (7) and main P1 tube from adjacent bracket on flange.

(8) Remove main P1 tube from inlet cowling (Ref. Aircraft Maintenance Manual).

(9) Post-SB24339 (PW305A only): If main P1 tube is being replaced, remove cap (5).

(10) Disconnect lower P1 tube (9) from pressure transducer.

(11) Remove nut (11), bolt (12), loop clamp (10) and lower P1 tube (9).

(12) If lower P1 tube is being replaced, remove cap (13).

(13) Put protective covers on electrical connectors and tube ends.

B. Installation (Ref. Figs. 202 and 205)

(1) Apply anti-seize compound (PWC06-009) to end fittings of lower P1 tube (9, Fig. 202), including shoulder of ferrule nut.

(2) Install tube (9) to EEC.

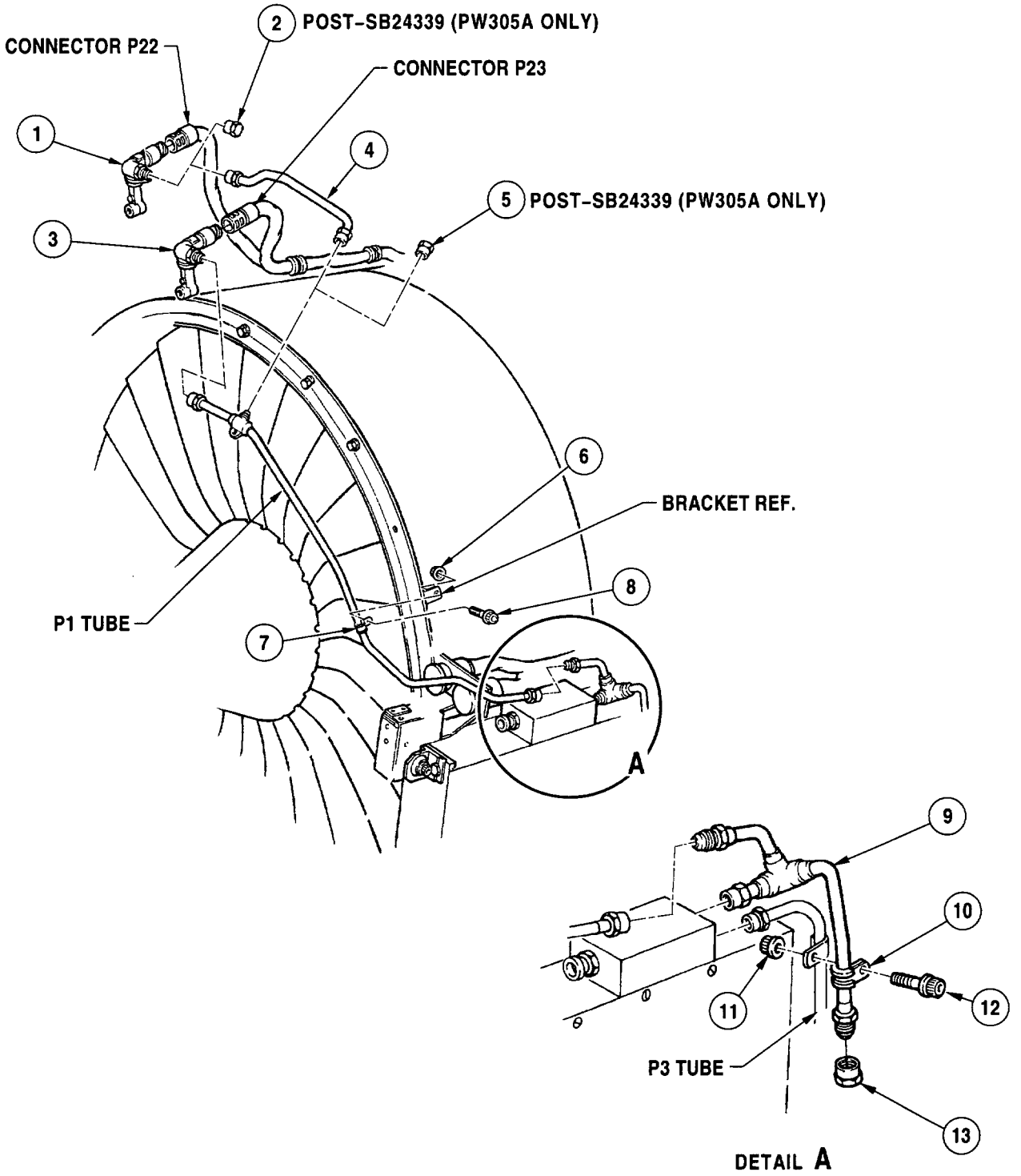
(3) Tighten coupling nut with your fingers.

(4) Install loop clamp (10) on tube (9) and attach to bracket on adjacent P3 tube with bolt (12) and nut (11).

(5) Torque nut (11) to 36 to 40 lb. in. (4.0-4.6 Nm).

(6) If removed, install cap (13) on lower P1 tube (7).

(7) Torque cap (13) 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).



Post-SB24198 (PW305A only)/Pre-SB24420 C85231A

P1/T1 Sensors and P1 Air Pressure Tube - Removal/Installation
Figure 202

Key to Figure 202

1. P1/T1 Sensor
2. Cap (Post-SB24339 (PW305A only))
3. P1/T1 Sensor
4. Tube (Post-SB24198 (PW305A only) and Pre-SB24339 (PW305A only))
5. Cap (Post-SB24339 (PW305A only))
6. Self-locking Nut
7. Loop Clamp
8. Bolt
9. Tube
10. Loop Clamp
11. Self-locking Nut
12. Bolt
13. Cap

(8) Post-SB24339 (PW305A only): Install caps (2 and 5) on P1/T1 sensor (1) and main P1 tube.

(9) Torque caps (2 and 5) 90 to 100 lb.in. (10.0-11.0 Nm), and install lockwire (PWC05-089), two places.

(10) Install P1/T1 sensors to inlet cowling (Ref. Aircraft Maintenance Manual).

(11) Apply anti-seize compound (PWC06-009) to main P1 tube end fittings including ferrule nut seating shoulder.

(12) Install main P1 tube between P1/T1 sensor (1) and lower P1 tube (9).

(13) Tighten coupling nuts with your fingers.

(14) Post-SB24198 (PW305A only) or Pre-SB24339 (PW305A only): Apply anti-seize compound (PWC06-009) to fittings of tube (4) including shoulder of ferrule nut.

(15) Post-SB24198 (PW305A only) or Pre-SB24339 (PW305A only): Install tube (4) between P1/T1 sensor (1) and main P1 tube.

(16) Tighten coupling nuts with your fingers.

(17) Torque lower P1 tube (9) coupling nut to EEC fitting 70 to 80 lb.in. (7.9-9.0 Nm).

(18) Pre-SB24339 (PW305A only): Torque coupling nuts of main P1 tube at sensor connection 70 to 80 lb.in. (7.9-9.0 Nm), and 90 to 100 lb.in. (10.0-11.0 Nm) at lower P1 tube (9).

(19) Post-SB24339 (PW305A only):

(a) Torque coupling nuts of main P1 tube at sensor 50 to 60 lb.in. (5.6-6.7 Nm).

(b) DELETED.

(c) Torque coupling nuts at lower P1 tube (9) 50 to 60 lb.in. (5.6-6.7 Nm).

(20) Install lockwire (PWC05-089) at two ends.

(21) Post-SB24198 (PW305A only): Hold tee connector fitting in position with wrench, torque coupling nuts of tube (4) 70 to 80 lb.in. (7.9-9.0 Nm) and install lockwire (PWC05-089) at two ends.

(22) Apply electrical contact enhancer to P22 and P23 connectors (Ref. Chapter 70-00-00, CLEANING).

CAUTION: TIGHTEN CONNECTORS WITH APPROVED TOOL(S) ONLY.

(23) Attach connectors P22 and P23 to P1/T1 sensors (1 and 3). Tighten each connector nut by hand until witness band on the mating receptacle is covered. It is recommended to further torque connector coupling nuts, with one of the methods that follow:

(a) Torque connectors 24 to 29 lb.in. (2.7 - 3.3 N.m) with wrench (PWC60142-100).

CAUTION: MINI-STRAP WRENCH HAS A DESIGN SLIP TORQUE OF 100 LB.IN. (11.3 Nm).

(b) Torque connectors with a mini-strap wrench (PWC58104) or Glenair TG70. Apply reasonable force to make sure connector coupling nut is firmly tightened.

CAUTION: SOFT JAWED PLIERS HAVE A DESIGN SLIP TORQUE OF 100 LB.IN. (11.3 Nm). DO NOT USE STEEL-JAWED PLIERS TO TIGHTEN CONNECTORS.

(c) Torque connectors with pliers Glenair TG69 or a similar tool. Apply reasonable force to make sure connector coupling nut is firmly tightened.

(24) Post-SB24473: Apply electrical insulation tape (PWC05-105) from the body of the receptacle to the backshell of the wiring harness connector as shown (Ref. Fig. 205). The tape must be stretched during this application and remain tight.

NOTE: Use of insulating tape to wrap electrical connectors is optional.

(25) Set maintenance test discrete to OFF (Ref. Aircraft Maintenance Manual).

(26) Pull EEC circuit breaker to OFF (Ref. Aircraft Maintenance Manual).

7. P1/T1 Sensors and P1 Air Pressure Tube (Post-SB24420 (PW305A and PW305B)/Pre-SB24434/Post-SB24514)

A. Removal (Ref. Fig. 203)

(1) Set maintenance test discrete to ON (Ref. Aircraft Maintenance Manual).

(2) Remove electrical connectors P22 and P23 from P1/T1 sensors (1 and 3). Check connectors for moisture. If necessary, dry connectors with suitable heat gun.

(3) Disconnect coupling nut of P1 tube from P1/T1 sensor (3).

(4) Remove P1/T1 sensors (1 and 3) from inlet cowling (Ref. Aircraft Maintenance Manual).

(5) If P1/T1 sensor (1) is being replaced, remove cap (2).

(6) Remove nut (4), bolt (6), loop clamp (5) from adjacent bracket at flange.

(7) Remove nut (9), bolt (8), loop clamp (7) from adjacent loop clamp on P3 tube.

(8) Remove P1 tube from EEC.

(9) Remove P1 tube from inlet cowling (Ref. Aircraft Maintenance Manual).

(10) If P1 tube is being replaced, remove cap (10).

(11) Put protective covers on electrical connectors and tube ends.

B. Installation (Ref. Figs. 203 and 205)

(1) Apply anti-seize compound (PWC06-009) to P1 tube fittings, including ferrule nut seating shoulder.

(2) If previously removed, install cap (10, Fig. 203) on P1 tube.

(3) Torque cap 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(4) Install P1 tube to EEC.

(5) Tighten coupling nut with your fingers.

(6) Install loop clamp (7) on P1 tube and attach to J bracket on adjacent P3 tube with bolt (8) and nut (9).

(7) Torque nut (9) 36 to 40 lb. in. (4.0-4.6 Nm).

(8) If previously removed, install cap (2) on P1/T1 sensor (1).

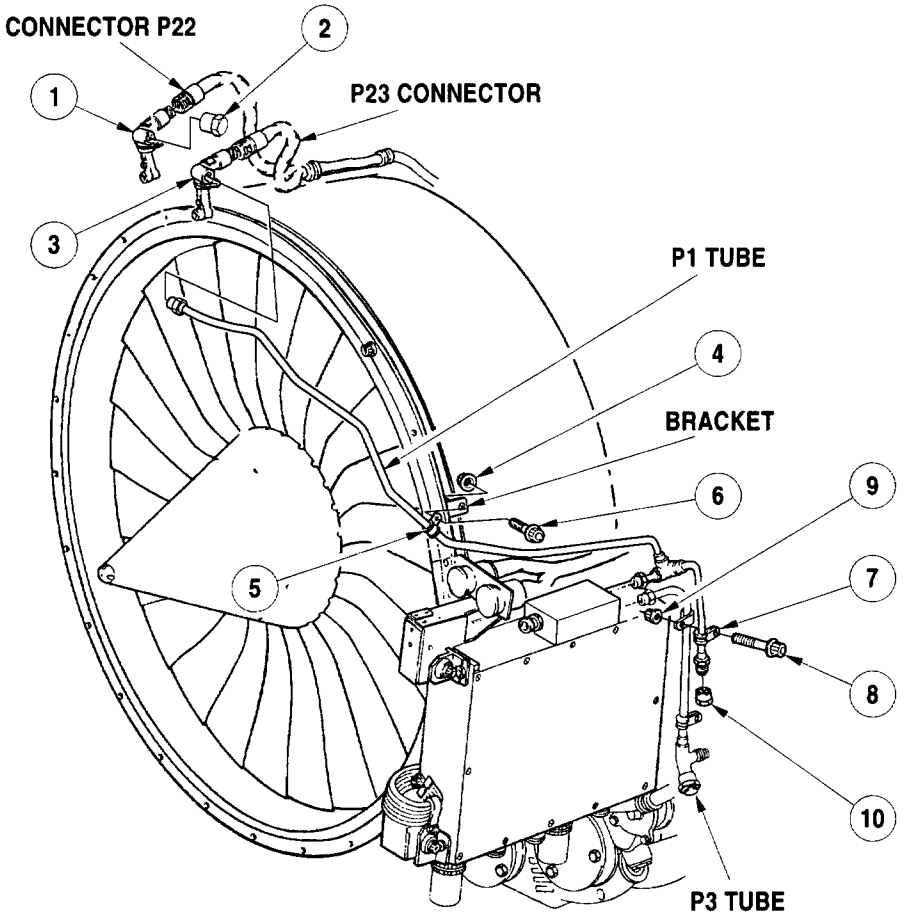
(9) Torque cap 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(10) Install P1/T1 sensors (Ref. Aircraft Maintenance Manual.

(11) Install P1 tube on reducer on respective P1/T1 sensor (3).

(12) Torque coupling nut of P1 tube at P1/T1 sensor 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(13) Apply electrical contact enhancer to connectors (Ref. Chapter 70-00-00, CLEANING).



Post-SB24420/Pre-SB24434/Post-SB24514 C85240

P1/T1 Sensors and P1 Air Pressure Tube - Removal/Installation
Figure 203

Key to Figure 203

1. P1/T1 Sensor
2. Cap
3. P1/T1 Sensor
4. Self-locking Nut
5. Loop Clamp
6. Bolt
7. Loop Clamp
8. Bolt
9. Self-locking Nut
10. Cap

CAUTION: TIGHTEN CONNECTORS WITH APPROVED TOOL(S) ONLY

(14) Attach connectors P22 and P23 to P1/T1 sensors (1 and 3). Tighten each connector nut by hand until witness band on the mating receptacle is covered. It is recommended to further torque connector coupling nuts, with one of the methods that follow:

(a) Torque connectors 24 to 29 lb.in. (2.7 - 3.3 N.m) with wrench (PWC60142-100).

CAUTION: MINI-STRAP WRENCH HAS A DESIGN SLIP TORQUE OF 100 LB.IN. (11.3 Nm).

(b) Torque connectors with a mini-strap wrench (PWC58104) or Glenair TG70. Apply reasonable force to make sure connector coupling nut is firmly tightened.

CAUTION: SOFT JAWED PLIERS HAVE A DESIGN SLIP TORQUE OF 100 LB.IN. (11.3 Nm). DO NOT USE STEEL-JAWED PLIERS TO TIGHTEN CONNECTORS.

(c) Torque connectors with pliers Glenair TG69 or a similar tool. Apply reasonable force to make sure connector coupling nut is firmly tightened.

(15) Post-SB24473: Apply electrical insulation tape (PWC05-105) from the body of the receptacle to the backshell of the wiring harness connector as shown (Ref. Fig. 205). The tape must be stretched during this application and remain tight.

NOTE: Use of insulating tape to wrap electrical connectors is optional.

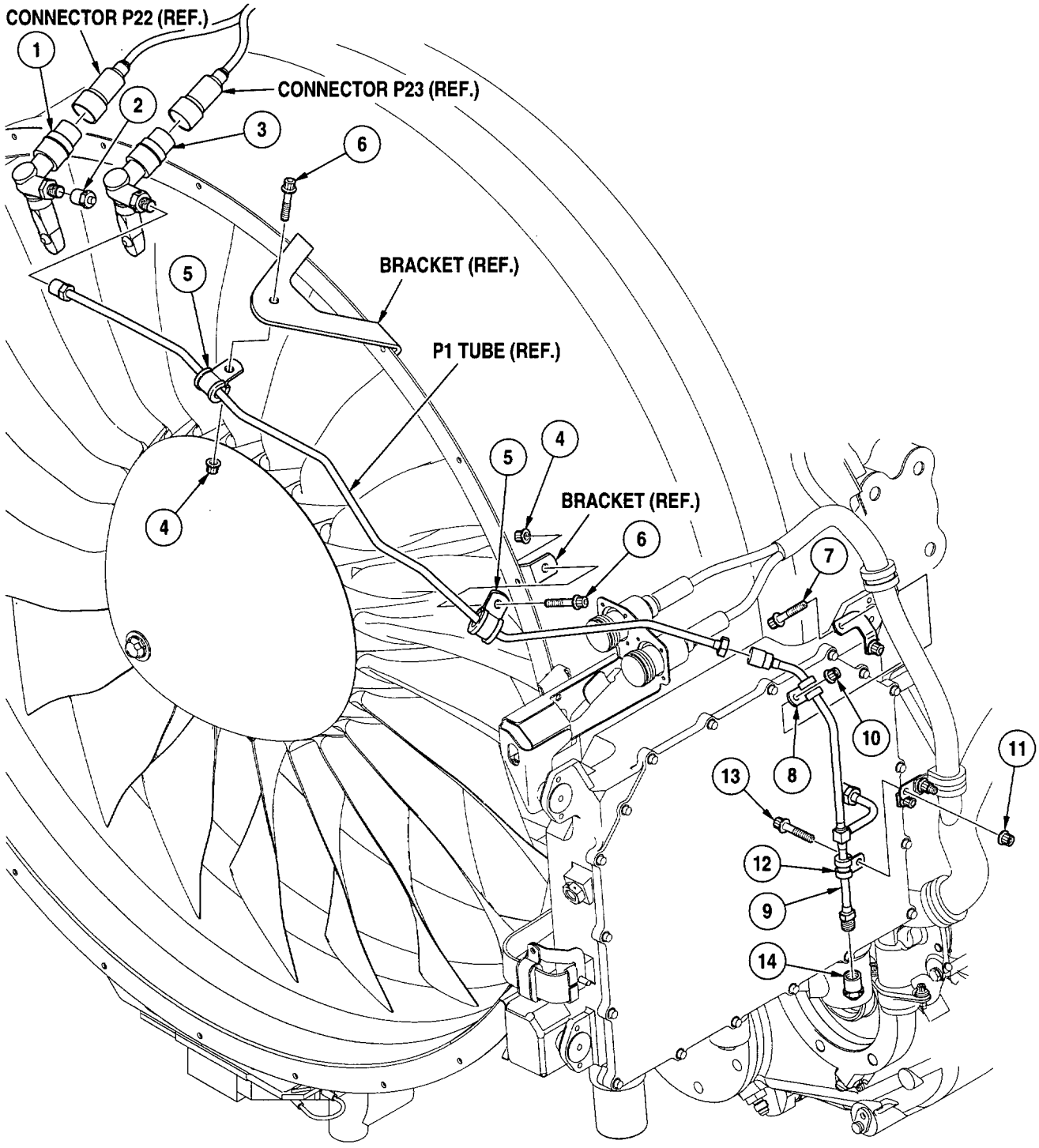
(16) Set maintenance test discrete to OFF (Ref. Aircraft Maintenance Manual).

(17) Pull EEC circuit breaker to OFF (Ref. Aircraft Maintenance Manual).

8. P1/T1 Sensors and P1 Air Pressure Tube (Post-SB24434/Pre-SB24514)

A. Removal (Ref. Fig. 204)

(1) Select maintenance test discrete ON (Ref. Aircraft Maintenance Manual).



Post-SB24434/Pre-SB24514 C85244A

P1/T1 Sensors and P1 Air Pressure Tubes - Removal/Installation
Figure 204

Key to Figure 204

1. P1/T1 Sensor
2. Cap
3. P1/T1 Sensor
4. Self-locking Nut
5. Loop Clamp
6. Bolt
7. Bolt
8. Loop Clamp
9. P1 Tube
10. Self-locking Nut
11. Self-locking Nut
12. Loop Clamp
13. Bolt
14. Cap

(2) Remove electrical connectors P22 and P23 from sensors (1 and 3). Check connectors for moisture. If necessary, dry connectors with suitable heat gun.

(3) Disconnect upper coupling nut of main P1 tube from sensor (3).

(4) Remove P1/T1 sensors (1 and 3) from inlet cowling (Ref. Aircraft Maintenance Manual).

(5) If P1/T1 sensor (1) is being replaced, remove cap (2).

(6) Disconnect coupling nut of main P1 tube from lower P1 tube (9).

(7) Remove nut (4), bolt (6), loop clamp (5) and main P1 tube from adjacent bracket on flange.

(8) Remove main P1 tube from inlet cowling (Ref. Aircraft Maintenance Manual).

(9) Disconnect lower coupling nut of tube (9) from Ptotal tube.

(10) Remove bolts (7 and 13) and nuts (10 and 11) fastening loop clamps (8 and 12) to adjacent EEC brackets.

(11) Remove lower P1 tube (9).

(12) If lower P1 tube (9) is being replaced, remove cap (14).

B. Installation (Ref. Figs. 204 and 205)

(1) Apply anti-seize compound (PWC06-009) to P1 tube fittings, including ferrule nut seating shoulder.

(2) Install P1/T1 sensors (1 and 3, Fig. 204) to inlet cowling (Ref. Aircraft Maintenance Manual).

(3) If removed, install cap (2) on P1 sensor (1).

(4) Torque cap 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(5) Install P1 tube to inlet cowling (Ref. Aircraft Maintenance Manual).

(6) Install loop clamp (5) on main P1 tube and fasten loop clamp to adjacent bracket on flange with bolt (6) and nut (4). Torque nut 36 to 40 lb.in. (4.0-4.6 Nm).

(7) Apply anti-seize compound (PWC06-009) to lower P1 tube (9) fittings, including ferrule nut seating shoulder.

(8) Fasten lower P1 tube (9) to Ptotal tube.

(9) Torque coupling nut 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(10) Install loop clamps (8 and 12) on lower P1 tube (9) and fasten to adjacent brackets on the EEC with bolts (7 and 13) and nuts (10 and 11). Torque nuts 36 to 40 lb.in. (4.0-4.6 Nm), two places.

(11) If removed, install cap (14) on lower P1 tube (9).

(12) Torque cap 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(13) Install upper coupling nut of main P1 tube to P1/T1 sensor (3).

(14) Torque coupling nut 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(15) Apply electrical contact enhancer to connectors (Ref. Chapter 70-00-00, CLEANING).

CAUTION: TIGHTEN CONNECTORS WITH APPROVED TOOL(S) ONLY.

(16) Attach connectors P22 and P23 to P1/T1 sensors (1 and 4). Tighten each connector nut by hand until witness band on the mating receptacle is covered. It is recommended to further torque connector coupling nuts, using one of the following methods:

(a) Torque connectors 24 to 29 lb.in. (2.7 - 3.3 Nm) with wrench (PWC60142-100).

CAUTION: MINI-STRAP WRENCH HAS A DESIGN SLIP TORQUE OF 100 LB.IN. (11.3 Nm).

(b) Torque connectors with a mini-strap wrench (PWC58104) or Glenair TG70. Apply reasonable force to make sure connector coupling nut is firmly tightened.

CAUTION: SOFT JAWED PLIERS HAVE A DESIGN SLIP TORQUE OF 100 LB.IN. (11.3 Nm). DO NOT USED STEEL-JAWED PLIERS TO TIGHTEN CONNECTORS.

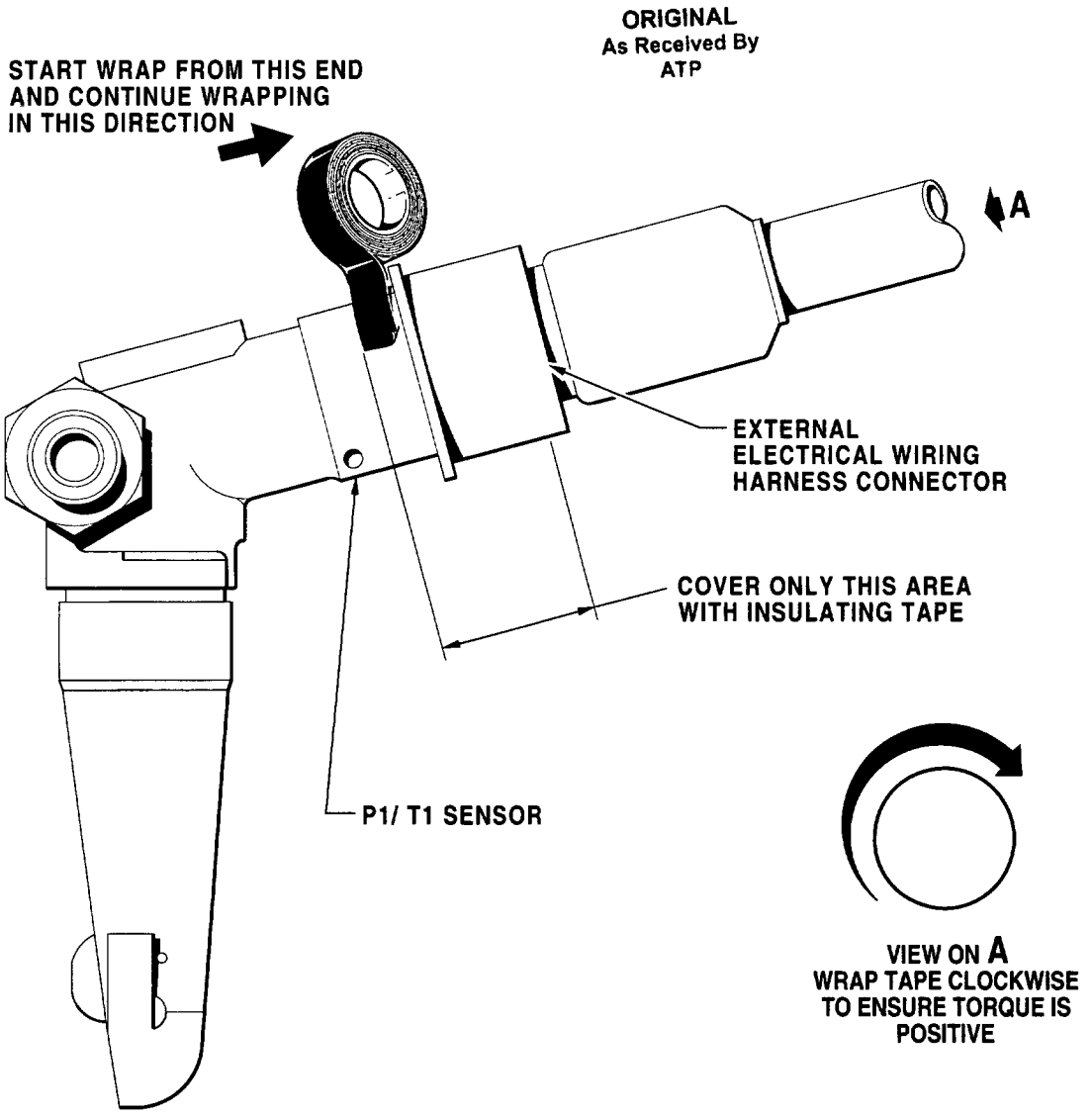
(c) Torque connectors with soft-jawed pliers Glenair TG69 or a similar tool. Apply reasonable force to make sure connector coupling nut is firmly tightened.

(17) Post-SB24473: Apply electrical insulation tape (PWC05-105) from the body of the receptacle to the backshell of the wiring harness connector as shown (Ref. Fig. 205). The tape must be stretched during this application and remain tight.

NOTE: Use of insulating tape to wrap electrical connectors is optional.

(18) Select maintenance test discrete OFF (Ref. Aircraft Maintenance Manual).

(19) Pull EEC circuit breaker to OFF (Ref. Aircraft Maintenance Manual).



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P1/T1 Sensors - Installation of Insulating Tape
Figure 205

CHAPTER 79

OIL

TABLE OF CONTENTS

SUBJECT	PAGE
OIL SYSTEM - DESCRIPTION AND OPERATION	**79-00-00**
1. General	1
2. Pressure Oil System	1
3. Scavenge Oil System	3
4. Breather System	3
5. Fuel/Oil Heat Exchanger	4

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Feb 27/2004
	2 blank	Feb 27/2004
Contents	1	Feb 27/2004
	2 blank	Feb 27/2004
79-00-00	1	Feb 27/2004
Description and	2	Feb 27/2004
Operation	3	Nov 19/99
	4	Nov 19/99
	5	Nov 19/99
	6 blank	Nov 19/99

OIL SYSTEM - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 1)

The lubrication system is an unregulated oil system which provides the required oil flow rate to the engine mainshaft bearings, all accessory drive gears and all accessory bearings, throughout the complete engine speed range. The oil flow lubricates and cools the bearings. Calibrated oil nozzles in the main engine bearing compartments ensure that the required oil flow is maintained under all operating conditions. The four mainshaft bearings are lubricated by under-race lubrication. The system consists basically of a pressure system, a scavenge system and a breather system.

2. Pressure Oil System (Ref. Fig. 1)

The oil tank is an integral annular cavity within the intermediate case, located between the bypass and core gas paths. It is a "hot-tank" type because the scavenge oil is not cooled before returning to the tank. Oil is drawn from the oil tank through a passage in the bottom strut of the intermediate case by a gear-type, fixed displacement pressure pump. The oil is delivered to the pressure adjusting valve (PAV) inlet of the oil filter assembly.

The PAV bleeds pressure oil in excess of the preset value back to the pressure pump inlet. The PAV position is set for each engine to give a pressure differential between the AGB oil feed pressure and the No. 3 bearing scavenge pressure at a specified engine speed and temperature. Provision is made for airframe connection to this pressure differential for cockpit indication. In addition, an engine mounted oil differential pressure switch provides an electrical indication if the pressure differential falls below 20 psid. A cold start valve, mounted in the Accessory Gearbox (AGB), diverts oil from the pressure pump outlet into the AGB sump if oil pressure over 200 psig occurs during cold weather operation.

From the PAV, oil passes through the oil filter, which incorporates a filter bypass valve as a safeguard against filter blockage. An impending bypass indicator in the oil filter housing provides both a pop-up type ground indicator, and an electrical cockpit warning, prior to bypass valve actuation.

A thermal lockout in the oil filter impending bypass switch prevents indication below 100°F oil temperature to avoid false indications at engine start-up with cold oil.

Oil from the filter outlet is routed through the dual matrix fuel/oil heat exchanger. The hot engine oil is cooled by bypass fuel from the hydro-mechanical metering unit (HMU).

External piping routes oil from the heat exchanger outlet to the anti-syphon device, which is integral with a boss on the side of the intermediate case. The anti-syphon device contains a small hole drilled through to the expansion space at the top of the oil tank. Following engine shut down, the anti-syphon hole serves to break the syphon action caused by the tank oil level being higher than the main bearing oil jets.

ORIGINAL
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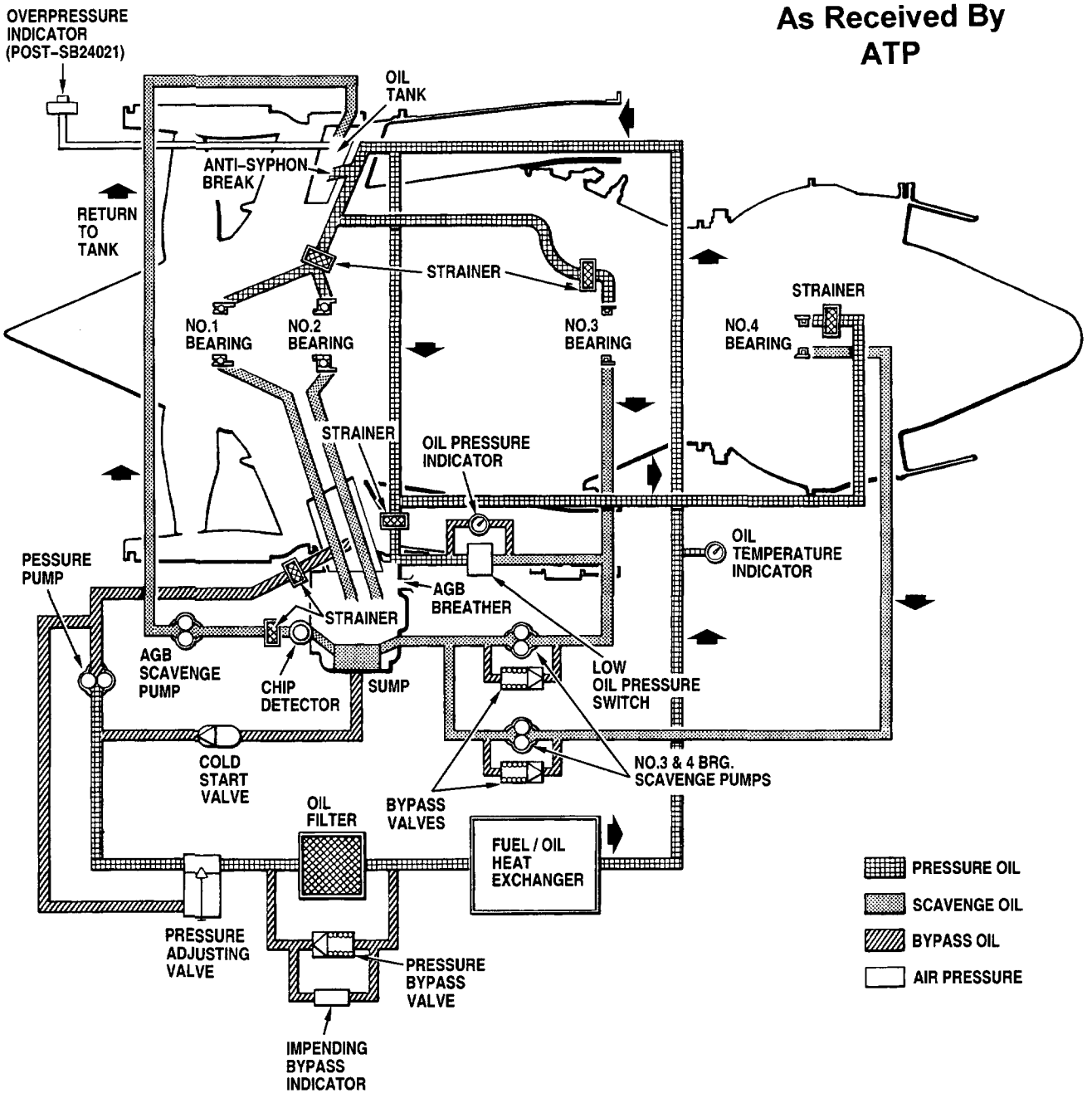
ATP



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Oil System - Schematic
Figure 1

From the anti-syphon device, pressure oil is directed by internal passageways in the intermediate case, to the No. 1 and 2 ball bearings, as well as to the outside diameters of the No. 1 and 2 bearings to provide squeeze film rotor damping. A tee-fitting on the rear of the intermediate case directs oil via transfer tubes to the towershaft plain bearing and to the top of the gas generator case, where an integral passageway in the diffuser section routes oil to the No. 3 roller bearing oil jet.

Pressure oil is also routed from the anti-syphon device down the side of the engine via external piping to a tee-fitting. The tee-fitting further divides the oil flow rearward to the No. 4 roller bearing, for bearing lubrication and squeeze film rotor damping, and downward to the AGB for lubrication of gearshaft plain and roller bearing elements, and the oil pump journals.

3. Scavenge Oil System (Ref. Fig. 1)

The scavenge oil system incorporates three double-element scavenge pumps. The pumps are gear-type, contained in cast housings within the AGB, and are driven by the fuel pump gearshaft. Oil from No. 1 and 2 bearing compartments is drained by gravity through the strut at the 6 o'clock position of the intermediate case, into the AGB sump. Scavenge oil from No. 3 and 4 bearings is pumped by separate elements of the oil pump assembly, through external transfer tubes along the bottom of the engine, into the AGB sump. The scavenge flow from all bearing compartments is aided by P2.8 pressurizing airflow through the labyrinth air seals. When the bearing scavenge is via a gear pump, bypass valves are incorporated around the pump elements to prevent pressure build-up in the scavenge lines at higher bearing cavity pressure conditions.

Scavenge oil, returned to AGB, collects in a sump at the bottom of the housing and is scavenged out by a separate scavenge pump element which returns it to the top of the oil tank via external piping up the side of the intermediate case.

A self closing magnetic chip detector is installed at the bottom of the AGB, in the scavenge oil passage, to provide indication of potential engine distress by monitoring the presence of contaminants or debris.

The oil pump drive train is arranged such that the main pressure pump elements will not be driven in the event of a failure of any of the scavenge pumps. This feature prevents oil flooding the engine core because of an inoperative oil scavenge pump.

4. Breather System

Breather air from engine bearing compartments and the AGB is vented overboard through an impeller type centrifugal air/oil separator installed on the alternator gearshaft in the AGB. The bearing compartments are connected to the AGB either by cored passages or by external scavenge oil return lines.

No. 1 and 2 bearing compartments vent via a hollow strut into the AGB. The No. 3 and 4 bearing compartments are vented to the AGB via No. 3 and 4 bearing scavenge oil tubes, and the oil tank is vented within the intermediate case.

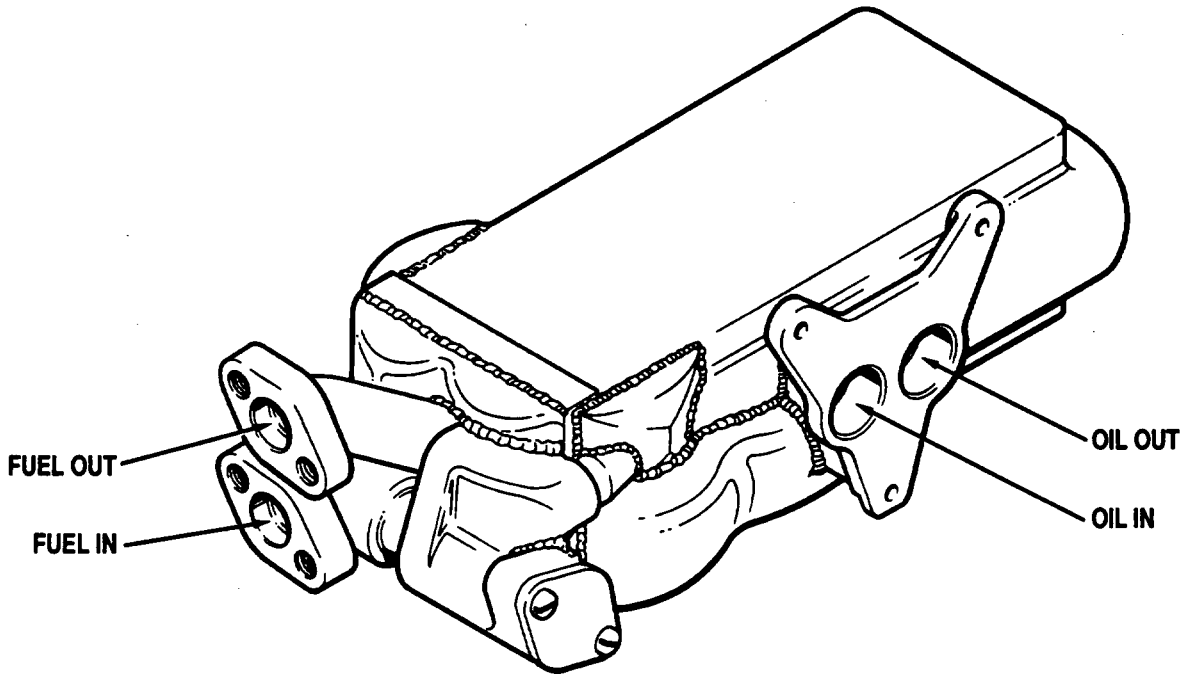
Post-SB24021 engines feature a differential oil pressure indicator, fitted just over the oil filler cap, to indicate any over-pressure condition in the AGB. A popped-out red button indicates an over-pressure condition in the AGB.

5. Fuel/Oil Heat Exchanger (Ref. Fig. 2)

The fuel/oil heat exchanger is mounted on the oil pressure manifold, which is in turn mounted on the left side of the accessory gearbox.

Engine lubricating oil enters the heat exchanger from the oil pressure manifold and is directed by baffles to flow around the tubes through which fuel flows. Heat transfer through the tube walls raises fuel temperature before it enters the fuel filter assembly. The fuel/oil heat exchanger also serves to cool engine oil prior to distribution to the engine bearings and accessory gearbox.

The fuel/oil heat exchanger body and matrix are made of aluminum and the whole assembly is brazed and welded into an integral unit. All external surfaces are anodized, coated with primer and finished with epoxy enamel, except fuel and oil mounting flanges.



C18669

Fuel/Oil Heat Exchanger
Figure 2

TABLE OF CONTENTS

SUBJECT	PAGE
OIL FILTER AND HOUSING - MAINTENANCE PRACTICES	**79-20-01**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Oil Filter Element	202
A. Removal	202
B. Installation	202
6. Oil Filter Housing	202
A. Removal from Engine	202
B. Remove Oil Pressure Manifold	203
C. Remove Oil Pressure Adjusting Valve (PAV)	203
D. Remove Oil Filter	205
E. Remove Oil Pressure Differential Switch	205
F. Install Oil Pressure Differential Switch	207
G. Install Oil Filter	209
H. Install Pressure Adjusting Valve	213
I. Install Oil Pressure Manifold	213
J. Installation on Engine	214
7. Pressure Adjusting Valve (PAV)	215
A. Removal	215
B. Installation	215
8. Oil Filter Impending Bypass Indicator and Bypass Valve	217
A. Removal	217
B. Installation	218

TABLE OF CONTENTS

SUBJECT	PAGE
OIL FILTER AND HOUSING - MAINTENANCE PRACTICES (Cont'd)	**79-20-01**
9. Inspection/Check	218
A. Oil Filter Element	218
B. Debris Analysis	218
C. Patch-Making Procedure	225
D. Debris in Oil System Inspection (Chip Detector and/or Oil Filter Bypass Warning)	226
E. Chip Detector Collected Debris Transfer	227
10. Cleaning/Painting	228
A. Oil Filter Bypass Valve and Pressure Adjusting Valve	228
11. Fits, Clearances and Torque Loadings	228
FUEL/OIL HEAT EXCHANGER - MAINTENANCE PRACTICES	**79-20-02**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Fuel/Oil Heat Exchanger	201
A. Removal	201
B. Installation	205
6. Oil Pressure Manifold Assembly	205
A. Removal	205
B. Installation	207
SCAVENGE OIL TUBES - MAINTENANCE PRACTICES	**79-20-03**
1. General	201
2. Consumable Materials	201
3. Special Tools	201

TABLE OF CONTENTS

SUBJECT	PAGE
SCAVENGE OIL TUBES - MAINTENANCE PRACTICES (Cont'd)	**79-20-03**
4. Fixtures, Equipment and Supplier Tools	201
5. Scavenge Oil Return to Tank Tube Assembly	201
A. Removal	201
B. Installation	201
6. No. 4 Bearing Scavenge Oil Tube Assembly	206
A. Removal	206
B. Installation	206
7. No. 4 Bearing Scavenge Oil Tube Assembly - AGB to Outer Bypass Duct	206
A. Removal	206
B. Installation	207
8. No. 3 Bearing Scavenge Oil Tube Assembly	207
A. Removal	207
B. Installation	207
9. Inspection/Check	208
A. Scavenge Oil Tubes	208
10. Cleaning/Painting	208
A. Scavenge Oil Tubes	208
PRESSURE OIL TUBES - MAINTENANCE PRACTICES	**79-20-04**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Anti-Syphon Pressure Oil Tube Assembly	201
A. Removal	201

TABLE OF CONTENTS

SUBJECT	PAGE
PRESSURE OIL TUBES - MAINTENANCE PRACTICES (Cont'd)	**79-20-04**
B. Installation	201
6. AGB and No. 4 Bearing Oil Pressure Tube Assembly	205
A. Removal	205
B. Installation	205
7. No. 4 Bearing to Bypass Duct Oil Pressure Tube Assembly	205
A. Removal	205
B. Installation	205
8. AGB Oil Pressure Tube Assembly	206
A. Removal	206
B. Installation	206
9. PAV-to-Pump Tube Assembly	206
A. Removal	206
B. Installation	206
10. No. 4 Bearing Oil Pressure Tube Assembly	207
A. Removal	207
B. Installation	207
11. Inspection/Check	207
A. Pressure Oil Tubes	207
12. Cleaning/Painting	208
A. Pressure Oil Tubes	208
13. Fits, Clearances and Torque Loadings	208
OIL PUMP ASSEMBLY - MAINTENANCE PRACTICES	**79-20-05**
1. General	201
2. Consumable Materials	201
3. Special Tools	201

TABLE OF CONTENTS

SUBJECT	PAGE
OIL PUMP ASSEMBLY - MAINTENANCE PRACTICES (Cont'd)	**79-20-05**
4. Fixtures, Equipment and Supplier Tools	201
5. Removal/Installation	201
A. Removal of Oil Pump Assembly (Pre-SB24367)	201
B. Installation of Oil Pump Assembly (Pre-SB24367)	203
C. Removal of Oil Pump Assembly (Post-SB24367)	204
D. Installation Oil Pump Assembly (Post-SB24367)	204
E. Removal of PAV and Cold Start Valve (Post-SB24367)	205
F. Installation of PAV and Cold Start Valve (Post-SB24367)	205
6. Adjustment/Test	207

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Nov 09/2007
	2	Nov 09/2007
Contents	1	Nov 09/2007
	2	Nov 09/2007
	3	Nov 09/2007
	4	Nov 09/2007
	5	Nov 09/2007
	6 blank	Nov 09/2007
79-20-01 Maintenance Practices	201	Mar 16/2007
	202	Mar 16/2007
	203	Mar 16/2007
	204	Mar 16/2007
	205	Mar 16/2007
	206	Mar 16/2007
	207	Mar 16/2007
	208	Mar 16/2007
	209	Mar 16/2007
	210	Mar 16/2007
	211	Mar 16/2007
	212	Mar 16/2007
	213	Mar 16/2007
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	225	Mar 16/2007
	226	Mar 16/2007
	227	Mar 16/2007
	228	Mar 16/2007
	229	Mar 16/2007
	230	Mar 16/2007
	231	Mar 16/2007
	232 blank	Mar 16/2007
79-20-02 Maintenance Practices	201	Nov 09/2007
	202	Nov 09/2007
	203	Nov 09/2007
	204	Nov 09/2007
	205	Nov 09/2007
	206	Nov 09/2007
	207	Nov 09/2007
	208 blank	Nov 09/2007
79-20-03 Maintenance Practices	201	Feb 27/2004
	202	Feb 27/2004
	203	Feb 27/2004
	204	Feb 27/2004
	205	Feb 27/2004
	206	Feb 27/2004
	207	Feb 27/2004
	208	Feb 27/2004
	209	Feb 27/2004
	210 blank	Feb 27/2004
79-20-04 Maintenance Practices	201	Nov 19/99
	202	Nov 19/99
	203	Nov 19/99
	204	Nov 19/99
	205	Nov 19/99
	206	Nov 19/99
	207	Nov 19/99
	208	Nov 19/99
	209	Nov 19/99
	210	Nov 19/99
79-20-05 Maintenance Practices	201	Jun 08/2001
	202	Jun 08/2001
	203	Jun 08/2001
	204	Jun 08/2001
	205	Jun 08/2001
	206	Jun 08/2001
	207	Jun 08/2001
	208	Jun 08/2001

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
	209	Jun 08/2001
	210 blank	Jun 08/2001

OIL FILTER AND HOUSING - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after sub-assembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-002	Layout Dye
PWC05-019	Lapping Compound
PWC05-041	Dye, Layout
PWC05-190	Filter Patch (60 Microns)
PWC11-027	Solvent
PWC11-048	Solvent

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC30128-07	Puller
PWC43131	Socket
PWC43172	Puller
PWC43173	Puller,
PWC60787	Adapter Plate
PWC60788	Lapping Handle
PWC60879	Pressure Test Kit

4. Fixtures, Equipment and Supplier Tools

   The fixtures, equipment and supplier tools listed below are referred to in procedural text.

Name	Remarks
Filter Holder	Filter patch holder (Millipore P/N xx1504700) and accessories
Petri Slide	Millipore P/N PD1504700 (needs to be added for shipping)

5. Oil Filter Element

A. Removal (Ref. Fig. 201)

(1) Remove three self-locking nuts (8) and washers (7) holding oil filter cover (6) to oil filter housing assembly (1).

NOTE: Whenever oil filter element (4) is being removed for a routine check or as a troubleshooting aid, the cover (6) should not be drained prior to removal in order to facilitate inspection of contents.

(2) Withdraw oil filter cover (6) with oil filter element (4) installed.

(3) Remove retaining ring (2) and withdraw filter element (4).

(4) Discard preformed packings (3 and 5).

B. Installation (Ref. Fig. 201)

CAUTION: MAKE SURE OIL FILTER ELEMENT IS FULLY SEATED IN COVER AND ELEMENT END CAP IS NOT HUNG UP ON FILTER BOWL LOCATING LUGS.

(1) Insert new oil filter element (4) into oil filter cover (6) with the three tangs uppermost and install retaining ring (2).

(2) Install new preformed packing (3) in oil filter element (4) and new preformed packing (5) in oil filter cover (6).

CAUTION: MAKE SURE THAT THE OIL FILTER COVER IS IN LINE WITH THE OIL FILTER HOUSING. DO NOT PINCH PACKINGS. TIGHTEN NUTS EVENLY IN A TRIANGULAR PATTERN.

CAUTION: MAKE SURE FILTER COVER IS FULLY SEATED BEFORE TIGHTENING AND TORQUING NUTS (8).

(3) Install oil filter cover (6) with oil filter element (4). Secure with three washers (7) and self-locking nuts (8). Torque nuts 32 to 36 lb.in. (3.6-4.0 Nm).

(4) Do an Oil Level Check (Ref. 72-00-00, SERVICING).

6. Oil Filter Housing

A. Removal from Engine (Ref. Fig. 202)

(1) Remove the oil pressure tube assembly from the pressure adjusting valve (Ref. 79-20-04).

(2) Remove the pressure adjusting valve (Ref. 79-20-01).

(3) Remove the anti-syphon oil pressure tube assembly from the oil filter housing (Ref. 79-20-04).

(4) Remove the scavenge oil return tube from the oil filter housing (Ref. 79-20-03).

(5) Remove two clamps of the outer wiring harness to provide space for the removal of the oil filter housing (Ref. 73-20-03).

(6) Remove two nuts (9) and bracket (8) securing oil filter housing bracket (10) to oil filter housing.

(7) Remove two bolts (6) and washers (7) and withdraw oil filter housing bracket (10).

(8) Support oil filter housing (2) and remove three bolts (4), two washers (3) and bracket (5). Remove oil filter housing.

(9) Remove three transfer tubes (12, 16 and 18) and oil pressure control tube (14).

(10) Remove and discard preformed packings (11, 13, 15 and 17).

(11) Place protective covers on all tube and oil filter housing openings.

(12) Place all removed parts in sealable plastic bags and identify with names and part numbers of contents.

B. Remove Oil Pressure Manifold (Ref. Fig. 203)

(1) Mount oil filter housing assembly on adapter plate (PWC60787) and secure plate in power arm.

(2) Remove two bolts (15) and adapter (14). Remove and discard preformed packing (13).

(3) Remove two nuts (8) and straight adapter (9). Remove and discard preformed packing.

(4) Remove tube cap (6) from tube-to-boss nipple (4).

(5) Remove two nuts (5) and tube-to-boss nipple (4). Remove and discard preformed packing (3).

(6) Remove three nuts (12) and washers (11). Remove oil pressure manifold (1) from oil filter housing (7). Remove and discard preformed packing (10).

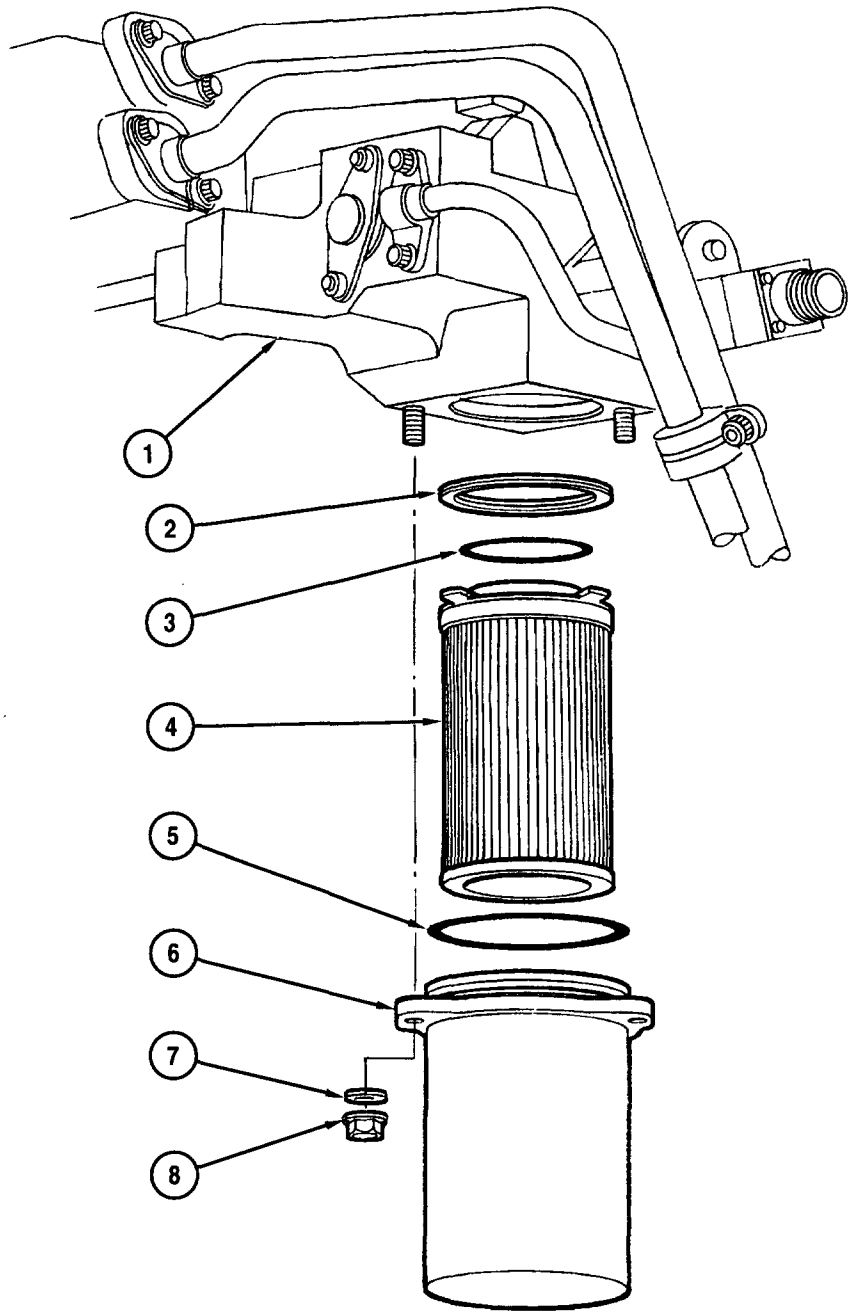
(7) Place protective covers on all oil pressure manifold and adapter openings. Place removed parts in clean plastic bags and tag with component name and part number.

C. Remove Oil Pressure Adjusting Valve (PAV) (Ref. Fig. 203)

(1) Remove two nuts (16) and using puller (PWC43172), remove oil PAV cover (15). Remove and discard preformed packing (14).

(2) Using a flat screwdriver, remove oil PAV (13).

(3) Using puller (PWC43173) remove oil PAV housing (19). Remove and discard preformed packings (17).



C18788

Oil Filter Element - Removal/Installation
Figure 201

Key to Figure 201

1. Oil Filter Housing
2. Retaining Ring
3. Preformed Packing
4. Oil Filter Element
5. Preformed Packing
6. Oil Filter Cover
7. Washer
8. Self-locking Nut

(4) Place protective covers on oil PAV housing and oil filter housing openings.

D. Remove Oil Filter (Ref. Fig. 204)

CAUTION: OIL FILTER COVER (6) MAY CONTAIN ENGINE OIL. USE CARE WHEN REMOVING COVER TO PREVENT SPILLAGE OF OIL.

(1) Remove three nuts (4), washer (5) and oil filter cover (6). Remove and discard preformed packing (3).

(2) Remove retaining ring (1) and oil filter element (2) from oil filter cover (6). Drain oil from cover (6) into clean container and save for inspection.

CAUTION: SPRING (12) IS UNDER COMPRESSION. USE CARE WHEN REMOVING HOUSING SLEEVE (8) TO PREVENT DAMAGE TO SLEEVE OR SPRING SEAT (10).

(3) Using socket (PWC43131) carefully remove oil filter housing sleeve (8), spring seat (10) and helical compression spring (12) from oil filter housing (20). Remove and discard preformed packings (7, 9) and seal ring (11).

E. Remove Oil Pressure Differential Switch (Ref. Fig. 205)

CAUTION: SPRING (2) IS UNDER COMPRESSION. USE CARE WHEN REMOVING NUTS (6) TO PREVENT DAMAGE TO PRESSURE DIFFERENTIAL SWITCH.

(1) Support oil pressure differential switch (5), and carefully remove two nuts (6).

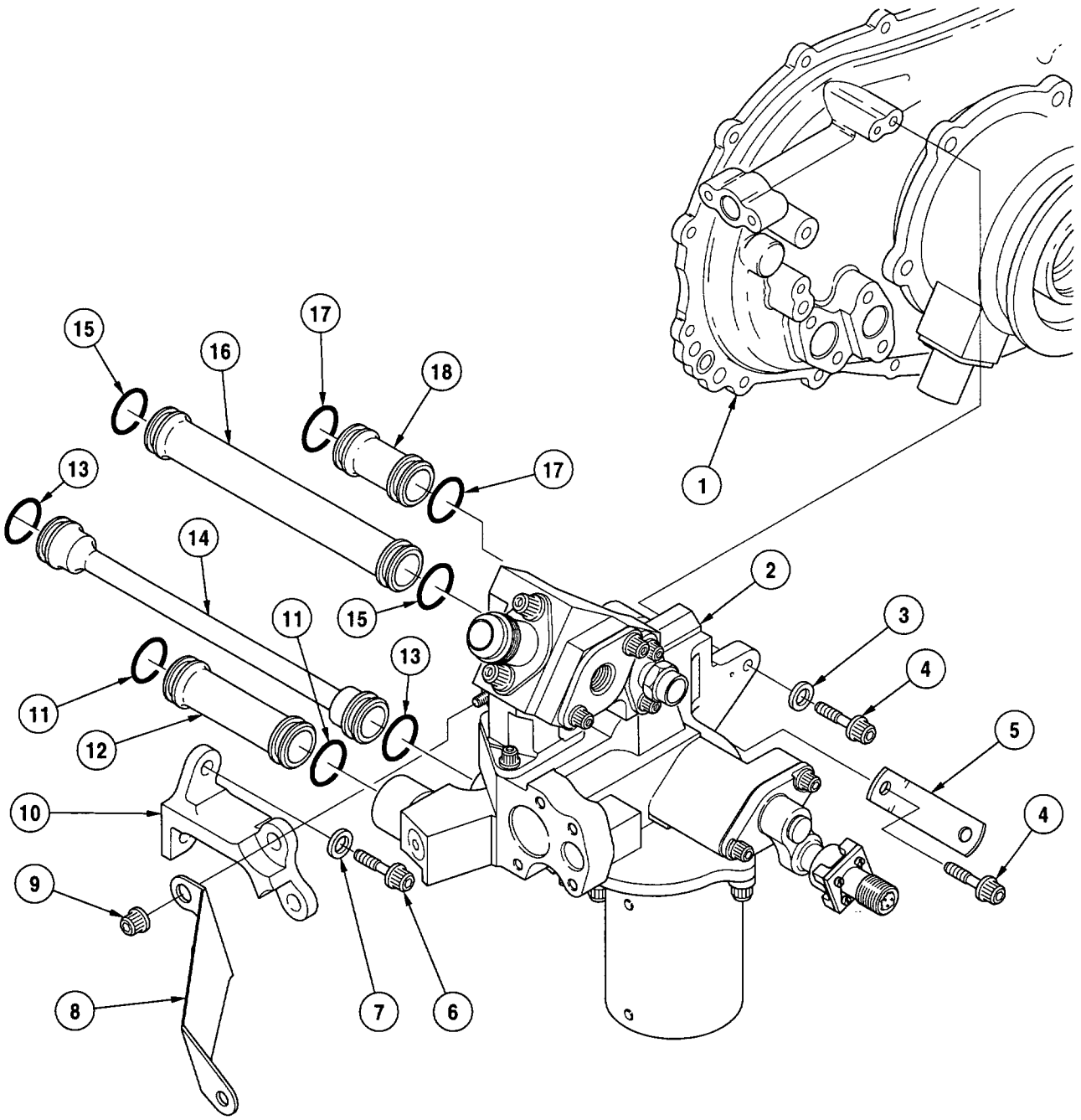
(2) Slowly withdraw oil pressure differential switch (5), releasing pressure on spring (2).

(3) Remove and discard two preformed packings (3, 4).

(4) Remove spring (2) and oil filter bypass valve (1) from oil filter housing (7).

(5) Place protective covers on all oil filter housing openings.

(6) Place all removed parts in clean, sealable plastic bags and tag with name and part number of contents.



C31499

Oil Filter Housing Installation - Removal/Installation
Figure 202

Key to Figure 202

1. Accessory Gearbox (Ref.)
2. Oil Filter Housing
3. Washer
4. Bolt
5. Bracket
6. Bolt
7. Washer
8. Bracket
9. Nut
10. Oil Filter Housing Bracket
11. Preformed Packing
12. Transfer Tube
13. Preformed Packing
14. Oil Pressure Control Tube
15. Preformed Packing
16. Transfer Tube
17. Preformed Packing
18. Transfer Tube

F. Install Oil Pressure Differential Switch (Ref. Fig. 205)

(1) Mount oil filter housing (7) on adapter plate (PWC60787) and secure adapter plate in power arm.

CAUTION: DO NOT ROTATE BYPASS VALVE IN FILTER HOUSING.

(2) Apply a thin even coat of layout dye (PWC05-041) to face of oil filter bypass valve (1) and insert valve into oil filter housing (7), allowing it to contact valve seat.

(3) Remove valve from housing and inspect. A continuous ring on valve seat area should be visible; a broken ring will indicate incomplete valve seating.

(4) Thoroughly clean parts.

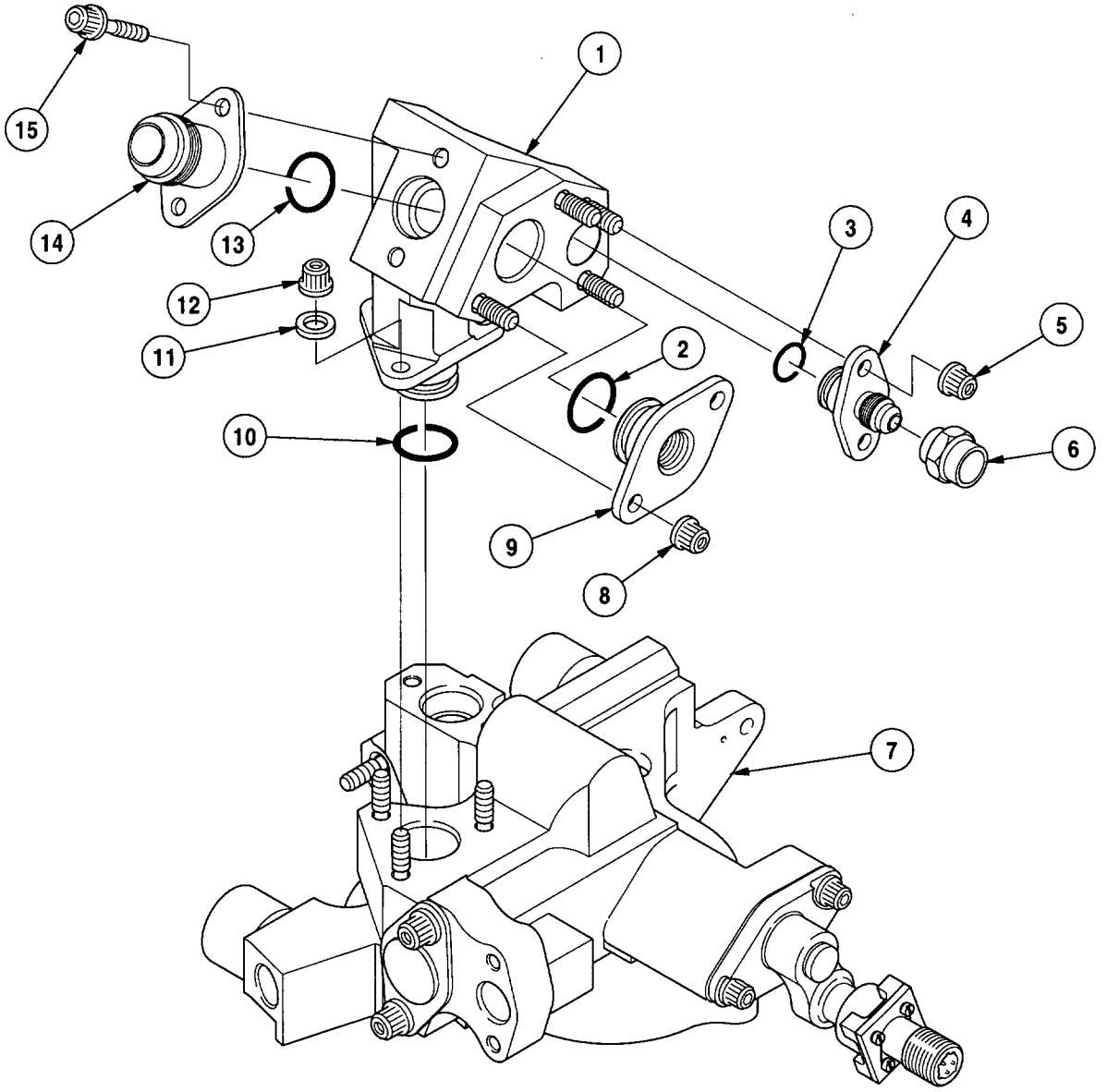
NOTE: If preceding steps indicate lapping of valve is required, proceed to step (5). If lapping is not required, proceed to step (9).

(5) Apply engine oil (PWC03-001) to valve face.

(6) Using lapping compound (PWC05-019) and lapping handle (PWC60788), lap valve face to valve seat.

(7) Thoroughly clean parts.

(8) Repeat steps (2), (3) and (4) preceding, to recheck valve seating. Repeat steps (4) through (7) as required to achieve correct seating.



C31591

Removal of Oil Pressure Manifold
Figure 203

Key to Figure 203

1. Oil Pressure Manifold Assembly (110, IPC FIG. 2)
2. Preformed Packing (70, IPC FIG. 2)
3. Preformed Packing (40, IPC FIG. 2)
4. Tube-to-boss Nipple (20, IPC FIG. 2)
5. Nut (30, IPC FIG. 2)
6. Tube Cap (10, IPC FIG. 2)
7. Oil Filter Housing Assembly (180, IPC FIG. 2)
8. Nut (60, IPC FIG. 2)
9. Straight Adapter (50, IPC FIG. 2)
10. Preformed Packing (170, IPC FIG. 2)
11. Washer (130, IPC FIG. 2)
12. Nut (120, IPC FIG. 2)
13. Preformed Packing (100, IPC FIG. 2)
14. Adapter (80, IPC FIG. 2)
15. Bolt (90, IPC FIG. 2)

(9) Install oil filter bypass valve (1) and helical compression spring (2) into oil filter housing (7).

(10) Lubricate new preformed packings (3, 4) and install on oil pressure differential switch (5).

(11) Compress spring (2) and install oil pressure differential switch (5) into oil filter housing (7) and secure with two nuts (6). Torque nuts 23 to 26 lb.in. (2.6-3.0 Nm).

(12) Using pressure test kit (PWC60879), pressure test oil filter bypass valve:

(a) Install plugs and slave preformed packings at five locations on oil filter housing. Install slave packing and dummy oil filter on housing.

(b) Remove oil filter housing from adapter plate and connect to oil pressure rig.

(c) With oil pressure at 25 psi check for leaks across valve. Maximum allowable leakage is 10 cc/min.

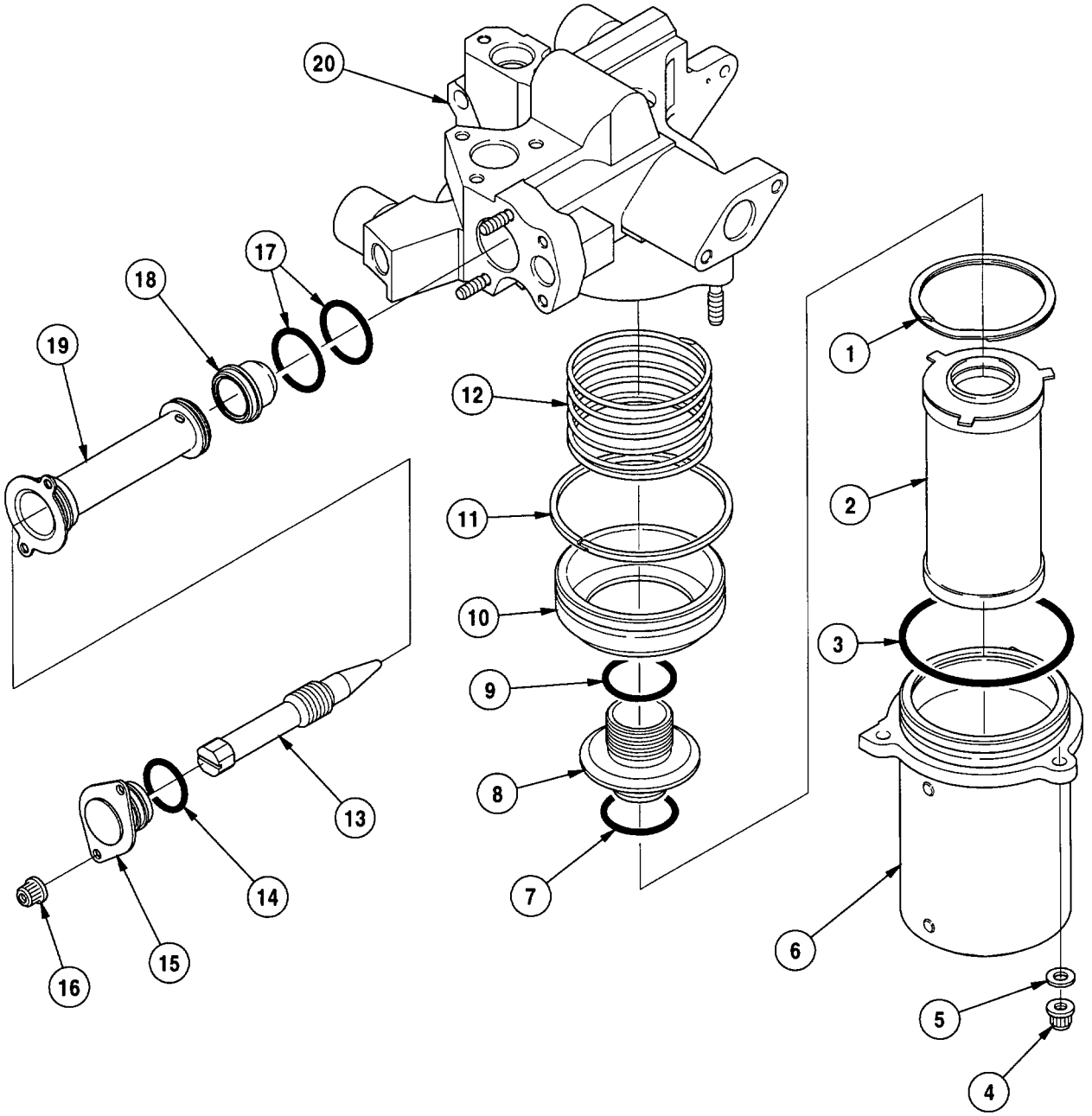
(d) Remove oil filter housing from oil pressure ring and reinstall on adapter plate (PWC60787).

(e) Remove plugs, dummy oil filter and slave packings of pressure test kit from oil filter housing.

G. Install Oil Filter (Ref. Fig. 204)

(1) Install new seal ring (11) on spring seal (10).

(2) Lubricate new preformed packing (9) and install on oil filter housing sleeve (8).



C31590

Removal of Oil Filter and Pressure Adjusting Valve
Figure 204

Key to Figure 204

1. Retaining Ring (50, IPC FIG. 1)
2. Oil Filter Element (60, IPC FIG. 1)
3. Preformed Packing (40, IPC FIG. 1)
4. Nut (20, IPC FIG. 1)
5. Washer (30, IPC FIG. 1)
6. Oil Filter Cover (10, IPC FIG. 1)
7. Preformed Packing (70, IPC FIG. 1)
8. Oil Filter Housing Sleeve (80, IPC FIG. 1)
9. Preformed Packing (90, IPC FIG. 1)
10. Spring Seat (100, IPC FIG. 1)
11. Seal Ring (110, IPC FIG. 1)
12. Helical Compression Spring (120, IPC FIG. 1)
13. Oil PAV (160, IPC FIG. 1)
14. Preformed Packing (150, IPC FIG. 1)
15. Oil PAV Cover (130, IPC FIG. 1)
16. Nut (140, IPC FIG. 1)
17. Preformed Packing (170, IPC FIG. 1)
18. Screen Assembly (190, IPC FIG. 1)
19. Oil PAV Housing (180, IPC FIG. 1)
20. Oil Filter Housing (180, IPC FIG. 1)

(3) Install helical compression spring (12), spring seat (10) and oil filter housing sleeve (8) onto oil filter housing (20). Using socket (PWC43131), torque sleeve 375 to 425 lb.in. (42.0-48.0 Nm).

(4) Lubricate new preformed packing (7) and install on oil filter housing sleeve (8).

(5) Lubricate new preformed packing (3) and install on oil filter cover (6).

CAUTION: ENSURE OIL FILTER ELEMENT (2) IS FULLY SEATED IN COUNTERBORE AT BOTTOM OF OIL FILTER COVER (6).

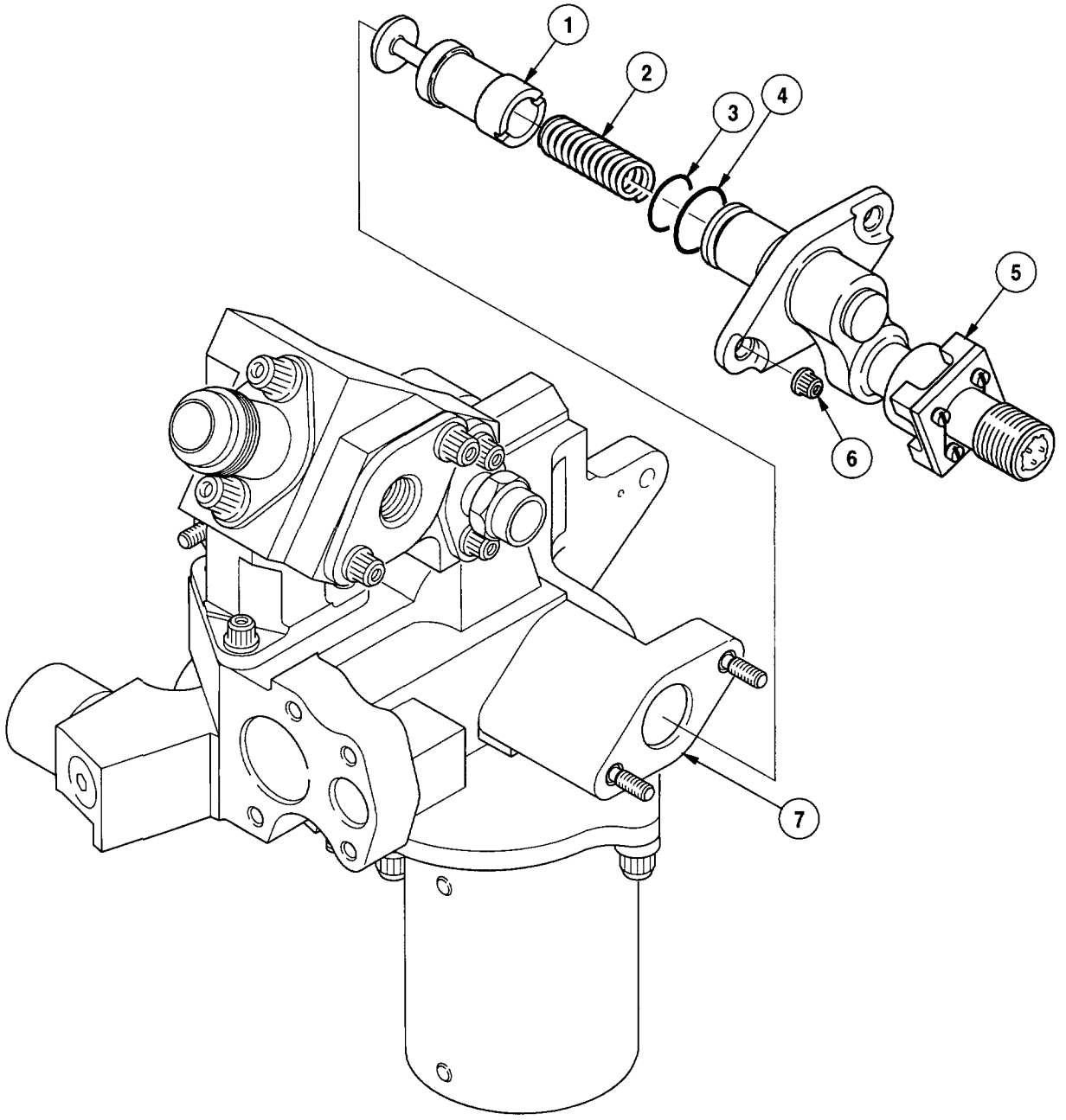
(6) Install oil filter element (2) into oil filter cover (6) ensuring element is properly seated.

(7) Install retaining ring (1) into oil filter cover (6).

CAUTION: MAKE SURE THAT THE OIL FILTER COVER IS IN LINE WITH THE OIL FILTER HOUSING. DO NOT PINCH PACKINGS. TIGHTEN NUTS EVENLY IN A TRIANGULAR PATTERN.

CAUTION: MAKE SURE FILTER COVER IS FULLY SEATED BEFORE TIGHTENING AND TORQUING NUTS (4).

(8) Install oil filter cover (6) to oil filter housing (20) and secure with three washers (5) and nuts (4). Torque nuts 23 to 26 lb.in. (2.6-3.0 Nm).



C31592

Removal of Oil Pressure Differential Switch
Figure 205

Key to Figure 205

1. Oil Pressure Bypass Valve (60, IPC FIG. 3)
2. Spring (50, IPC FIG. 3)
3. Preformed Packing (30, IPC FIG. 3)
4. Preformed Packing (40, IPC FIG. 3)
5. Oil Pressure Differential Switch (10, IPC FIG. 3)
6. Nut (20, IPC FIG. 3)
7. Oil Filter Housing Assembly (Ref.)

H. Install Pressure Adjusting Valve (Ref. Fig. 204)

(1) Lubricate two new preformed packings (17) and install on PAV housing (19).

(2) Install PAV housing assembly (19) into oil filter housing (20).

NOTE: Screen (18) and PAV housing (19) are an assembly and will only be separated for repair purposes.

(3) Install PAV (13) into valve housing (19). Screw valve into housing until it makes light contact with housing seat, then back valve out one-and-one-half turns.

(4) Lubricate new preformed packing (14) and install on oil PAV cover (15).

(5) Install oil PAV cover (15) on studs of oil filter housing (20) and secure with two nuts (16). Torque nuts 23 to 26 lb.in. (2.6-3.0 Nm).

I. Install Oil Pressure Manifold (Ref. Fig. 203)

(1) Lubricate new preformed packing (10) and install on spigot of oil pressure manifold assembly (1).

(2) Install oil pressure manifold assembly (1) on oil filter housing assembly (7) and secure with three washers (11) and nuts (12). Torque nuts 23 to 26 lb.in. (2.6-3.0 Nm).

(3) Lubricate new preformed packing (3) and install on tube-to-boss nipple (4).

(4) Install nipple (4) on oil pressure manifold assembly (1) and secure with two nuts (5). Torque nuts 23 to 26 lb.in. (2.6-3.0 Nm).

(5) Install cap (6) on nipple (4). Torque cap 65 to 75 lb.in. (7.5-8.5 Nm).

(6) Lubricate new preformed packing (2) and install on straight adapter (9).

(7) Install adapter (9) on oil pressure manifold assembly (1) and secure with two nuts (8). Torque nuts 23 to 26 lb.in. (2.6-0.3 Nm).

(8) Lubricate new preformed packing (13) and install on adapter (14).

(9) Install adapter (14) on oil pressure manifold (1) and secure with two bolts (15). Torque bolts 36 to 40 lb.in (4.0-4.6 Nm).

(10) Place protective covers on all openings.

(11) Place completed assembly in clean sealable plastic bag and label with engine serial number and name of contents.

J. Installation on Engine (Ref. Fig. 202)

CAUTION: DO NOT LUBRICATE THREADS OF STUDS WHEN INSTALLING OIL FILTER HOUSING BRACKET (10).

(1) Install oil filter housing bracket (10) and bracket (8) over studs on oil filter housing (2) and secure with two nuts (9). Torque nuts 20 to 25 lb.in. (2.2-2.8 Nm).

NOTE: Lubricate preformed packings (11, 13, 15 and 17) with engine oil (PWC03-001) prior to installation on transfer tubes.

(2) Install two new preformed packings (11) on transfer tube (12) and insert transfer tube into boss on oil filter housing (2).

(3) Install two new preformed packings (13) on oil pressure control tube (14) and insert tube into boss on oil filter housing (2).

(4) Install two new preformed packings (15) on transfer tube (16) and insert tube into boss on oil filter housing (2).

(5) Install two new preformed packings (17) on transfer tube (18) and insert tube into boss on oil filter housing (2).

CAUTION: WHEN INSTALLING OIL FILTER HOUSING, ENSURE ALL TRANSFER TUBES AND OIL PRESSURE CONTROL TUBE ARE CENTRALIZED IN THEIR RESPECTIVE MATING BORE CHAMFERS BEFORE PUSHING ON OIL FILTER HOUSING.

(6) Install oil filter housing (2) engaging slave guide pins, transfer tubes (12, 16 and 18) and oil pressure control tube (14). Secure with two washers (3), one bracket (5) and three bolts (4). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(7) Remove three slave guide pins and secure oil filter housing bracket (10) to oil pressure manifold with two washers (7) and bolts (6). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(8) Loosen two nuts (9) to zero torque and, without lubrication, torque nuts 45 to 60 lb.in. (5.0-6.8 Nm).

(9) Install the scavenge oil return tube assembly to oil filter housing (Ref. 79-20-03).

(10) Install the anti-syphon oil pressure tube assembly (Ref. 79-20-04).

(11) Install the pressure adjusting valve (Ref. 79-20-01).

(12) Install the oil pressure tube assembly to the pressure adjusting valve (Ref. 79-20-04).

(13) Install two clamps of the outer wiring harness (Ref. 73-20-03).

7. Pressure Adjusting Valve (PAV)

A. Removal (Ref. Fig. 206)

(1) Drain oil tank (Ref. 72-00-00, SERVICING).

(2) Pre-SB24014:

(a) Remove two nuts (9) and remove cover (10) using puller (PWC43172). Discard preformed packing (11).

(3) Post-SB24014:

(a) Remove two nuts (9) and shield (16). Remove cover (10) using puller (PWC43172).

(4) Unscrew valve (12) from valve housing (13).

NOTE: Record number of turns for reference at reassembly.

(5) Remove valve housing (13) from oil filter housing (1) using puller (PWC30128-07) and discard preformed packings (15).

B. Installation (Ref. Fig. 206)

(1) Install new preformed packings (15) on PAV housing (13) and install in oil filter housing (1).

(2) Screw valve (12) into valve housing (13) the same number of turns as recorded during removal.

(3) If new valve (12) is being installed, proceed as follows:

(a) Screw valve (12) into housing (13) until it contacts valve seat.

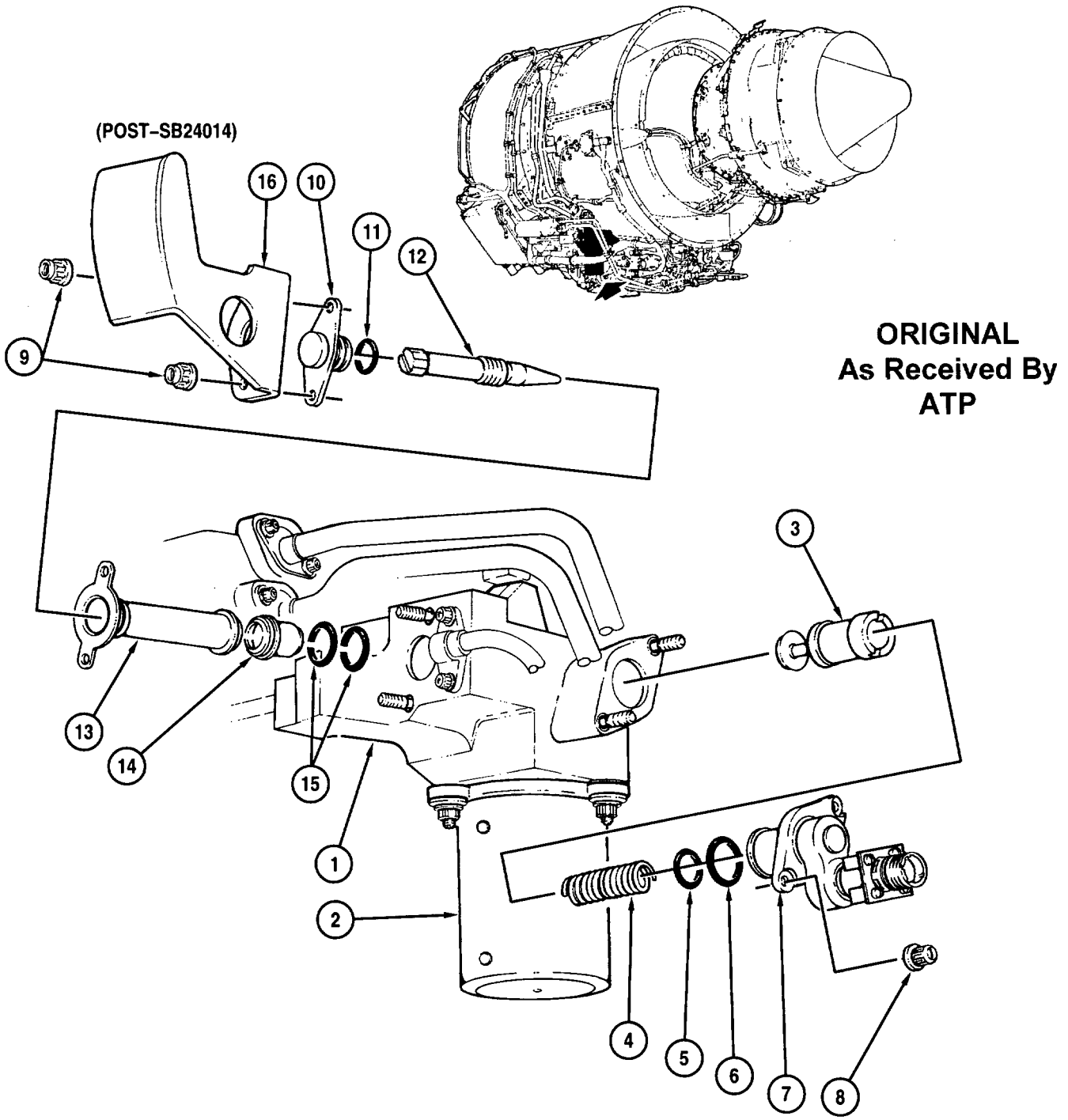
(b) Unscrew valve (12) one and one-half turns.

CAUTION: DO NOT LUBRICATE THREADS.

(4) Pre-SB24014:

(a) Install new preformed packing (11) on cover (10) and install on filter housing (1).

(b) Secure with two self-locking nuts (9). Torque 27 to 30 lb.in. (3.0-3.4 Nm).



PAV and Oil Filter Bypass Valve - Removal/Installation
Figure 206

Key to Figure 206

1. Oil Filter Housing (Ref.)
2. Oil Filter (Ref.)
3. Oil Filter Bypass Valve
4. Spring
5. Preformed Packing
6. Preformed Packing
7. Oil Pressure Differential Switch
8. Self-locking Nut
9. Self-locking Nut
10. PAV Cover
11. Preformed Packing
12. PAV
13. PAV Housing
14. Screen Assembly
15. Preformed Packing
16. Heat Exchanger Shield (Post-SB24014)

CAUTION: DO NOT LUBRICATE THREADS.

(5) Post-SB24014:

(a) Install new preformed packing (11) on cover (10) and install on filter housing (1).

NOTE: Valve (12) may be turned slightly to permit alignment of cover (10) with square end of stem.

(b) Install shield (16) and secure with two self-locking nuts (9). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

(6) Refer to Chapter 71-00-00 for adjustment of engine oil pressure.

8. Oil Filter Impending Bypass Indicator and Bypass Valve

A. Removal (Ref. Fig. 206)

(1) Drain oil system (Ref. 72-00-00, SERVICING).

(2) Disconnect airframe cable connector from bypass indicator.

(3) Remove two nuts (8) and withdraw oil pressure differential switch (7). Discard preformed packings (5 and 6).

(4) Withdraw spring (4) and oil filter bypass valve (3).

B. Installation (Ref. Fig. 206)

(1) Position spring (4) in core of bypass valve (3) and insert valve into filter housing (1) with spring end out.

(2) Install new preformed packings (5 and 6) on oil pressure differential switch (7) and install into oil filter housing. Secure with two self-locking nuts (8). Torque nuts 23 to 26 lb.in. (2.3-3.0 Nm).

9. Inspection/Check

NOTE: For periodic inspection refer to Chapter 05-20-00.

A. Oil Filter Element

(1) Visually inspect filter as follows:

(a) If more than 5 percent of the visible passages are blocked, filter element must be discarded.

(b) If filter element is distorted, dented, or broken wires are found, discard filter element.

(c) If debris is evident, proceed as follows:

1 Use a magnet and determine if any of the debris is magnetic. If magnetic debris is found, use a magnifying glass and inspect. Analyze debris and take appropriate action (Ref. Subpara. B.).

2 Carry out a patch making procedure (Ref. Subpara. C.).

3 When analysis results are received, inspect oil system (Ref. Subpara. D.

B. Debris Analysis

NOTE: All debris, allowable and non-allowable Category 2 and 3, must be sent to a laboratory for analysis (Ref. Step (9) following).

(1) Visually inspect debris, using magnifying glass and/or microscope.

(2) Allowable Debris:

(a) Small quantity of hair-like filaments, fuzz, or powder, providing there has been no prior history of debris, Allowable or Non-allowable, generation within the last 400 flight hours.

(3) Non-allowable Debris, Category 1:

(a) Keywasher keys, tooth segments, etc.

(4) Non-allowable Debris, Category 2:

(a) Large quantities of hair-like filaments (fuzz) or powder.

NOTE: Large quantity is defined as sufficient fuzz and/or powder filaments to completely cover the chip detector magnetic poles.

(b) Any quantity of hair-like filaments (fuzz) or powder if the engine has a history of generating debris (allowable or non-allowable) within the last 400 flight hours.

(5) Non-allowable Debris, Category 3:

(a) Dark irregular magnetic chips, minimum dimension 0.010 in. (0.254 mm).

(b) Small clusters of magnetic flakes (three or more).

NOTE: Thin, shiny rolled flakes with feathered edges and more than 0.020 in. (0.508 mm) in size are generated when bearing surfaces break down due to excessive load (spalling). The outer surface of the flakes is highly polished and may show parallel impressions. The inner surface has a rough wavy or granular texture. After the bearing surface breaks down, the underlying material disintegrates and chips with dark, coarse and irregular shapes are produced.

(c) All other debris not defined above.

(6) If bearing material AMS6444 (52100) or AMS6491 (M50) or AMS6414 or AMS6415 is found replace the engine immediately.

(7) If results show gear (AMS6265) or any other ferrous material, continue in service. Remove and inspect oil filter after engine after approximately 50 flight hours (Ref. Subpara. D., (7), (c) for subsequent action).

(8) The most frequent non-magnetic materials found in filter debris are:

(a) Aluminum - Thin Needle like Fragments and Powder

1 Source - The most probable source of these types of contamination is the main/scavenge oil pump housings/covers. Fragments are produced when the pump's inner wall is scratched or grooved. Powder is the result of cavitation or erosion.

2 Action Required- If more than 10 fragments are found, remove oil pumps, inspect the housings and covers and replace as necessary. If powder and/or less than 10 fragments are found, continue in service while monitoring oil pressure. If oil pressure drops significantly, remove and inspect engine oil pumps.

(b) Silver Plating - Flakes

1 Source - The most probable sources of this debris is silver-plated nuts.

2 Action Required - None. This type of debris is acceptable and the engine can continue in service.

(c) Magnesium Powder

1 Source - The most probable source of this contamination is the accessory gearbox and could be caused by bearing outer races fretting in the housing bores.

2 Action Required - If this type of debris is found, the engine can continue in service providing an oil filter patch check is done every 250 flight hours and the amount of magnesium powder is monitored. If the amount of debris increases, replace the accessory gearbox.

(d) Carbon Particles

1 The most common non-metallic debris is carbon particles caused by thermal breakdown of the oil due to hotspots in the engine. This type of debris is acceptable and the engine can continue in service with no special inspection required.

2 However, if an oil filter impending bypass indication occurred, and the amount of debris collected on the oil filter and housing does not indicate a bypass has actually occurred, and the major contaminant is carbon. proceed as follows:

a Drain flush and refill oil system return engine to service.

b Remove and inspect oil filter for debris after engine has run for approximately 50 flight hours.

c If the engine continues to generate carbon and the debris quantity is the same or has increased an engine removal is recommended.

(e) Silica Particles

1 Source - Silica debris indicates dirt or atmospheric pollutants may have entered the oil system via labyrinth seal pressurization air and/or while replenishing oil. Excessive amounts of silica can indicate blocked cooling air passages and worn labyrinth seals.

2 Action Required - To restore the silica content to normal levels, an oil change is required. Engine can remain in service providing oil consumption and T45 are within limits.

(f) Copper Fragments

1 Source - Usually found with fiber insulating material and paint chips in the accessory gearbox scavenge oil strainer. This type of debris may be caused by failure of electrical equipment.

2 Action Required - Engine can remain in service. Inspect the oil filter after 50 flight hours. If engine continues to generate copper and the quantity is increasing inspect permanent magnet alternator, PMA.

(9) Debris analysis should be done by a qualified laboratory; some of which are listed below.

Air Alliance (M-50, bearing alloy ONLY)
Engine Shop Supervisor
611, 6ieme Ave.
Saint-Foy, QC
G2E 5W1 Canada

TEL: (418) 877-7622
FAX: (418) 872-8337

Alfa Romeo Avio Laboratory
80038 Pomigliano D'Arco
Napoli, Italy

TEL: 39-81-8430493
FAX: 39-81-8846522

Analysts Inc.
OIS Wear Division
3075 Cornors North Court
Norcross, GA
30071, USA

TEL: (404) 448-5235
FAX: (404) 448-5918

Areco Canada Inc.
40 Camelot Drive
Nepean, ON
K2G-5W6, Canada

TEL: (613) 228-1145
FAX: (613) 228-1148

Aviation Laboratories Inc.
DELETED
Gardena, CA
USA

Aviation Laboratories Inc.
New Orleans International Airport
918 Maria Street
Kenner, LA
70062, USA

TEL: (504) 469-6751
FAX: (504) 469-6886

Chemical Analyst Laboratory
Department of Biochemistry
Trinity Collage
Dublin 2
Ireland

TEL: 772941, Ext: 1574
FAX: 772400

Det Norske Veritas Pte. Ltd.
10 Science Park Drive
DNV Technology Center
Singapore 118224
Malaysia

TEL: 65-6779-6363
FAX: 65-6779-5239

E-mail: asim.bag@dnv.com

Deutsche Lufthansa AG
POSTFACH 300
2000 Hamburg 63
Germany

Jet-Care International Inc.
3 Saddle Road
Cedar Knolls, New Jersey
07927-902, USA

TEL: (201) 292-9597
FAX: (201) 292-3030

Martel Laboratory Services Inc.
1025 Cromwell Bridge Road
Baltimore, MD
21204-3309, USA

TEL: (301) 825-7790
FAX: (301) 821-1054

Martel Laboratory Services Inc.
Aero Services Building
Capital Airport
Spring field, IL
62707, USA

TEL: (217) 522-0009
FAX: (217) 544-2034

Martel Laboratory Services Inc.
250 Meadowfern
Suite 102
Houston, TX
77067, USA

TEL: (713) 872-9100
FAX: (713) 872-7916

Materials Research Laboratories
Industrial Technology Research Institute
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Taiwan

Metro Tech Systems Ltd.
Bay 112
5621-11th Street N.E.
Calgary, AB
T2E 7G9, Canada

TEL: (403) 295-8803
FAX: (403) 295-3848

PCAS (Produits Chimiques Auxiliaires et Syntheses)
Zone Industrielle de la Vigne aux Loups
23 Rue Bosselet
91-161 Long-Jumeau
France

FAX: (1) 64-482319

Predictive Maintenance Corporation
400 Sauve Street West, Suite 101
Montreal, QC
H3L 1Z8, Canada

TEL: (514) 383-6330
FAX: (514) 383-5631

Predictive Maintenance Corporation
206, 2723-37 Avenue NE
Calgary, AB
T1Y 5R8, Canada

TEL: (403) 250-8378
FAX: (403) 286-8287

QinetiQ Ltd.
Building 442
Pyestock
Farnborough, Hampshire GU 14 0LS
England

TEL: (44) 1252 37 4776/4775
(Off-hour) (44) 7771 808 541
FAX: (44) 1252 37 4709

Setsco Services Pte. Ltd.
18 Teban Gardens Cresent
Singapore 608925
Malaysia

TEL: 65-6566-7777
FAX: 65-6566-7718

E-mail: chuasl@setsco.com

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Palace Gate
High Street
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C. Patch-Making Procedure

CAUTION: PATCH-MAKING PROCEDURE IS NOT A CLEANING PROCEDURE FOR FILTER ELEMENTS.

(1) Remove oil filter element from engine.

(2) Seal inner cavity of filter element with suitable tapered plugs.

(3) Place filter in cylindrical container.

WARNING: REFER TO MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIALS INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

(4) Fill container with solvent (PWC11-048), enough to cover filter element but leaving a space for liquid movement when shaking, and install cover.

(5) Shake container for about three minutes manually, or 30 seconds in a vibrator.

(6) Remove cover. Make sure there are no deposits left on filter. If there is, install container cover and continue shaking.

(7) Install new filter patch (PWC05-190) in filter patch holder and place over a suitable container 0.5 gal (2 liters) min.

(8) Remove filter element from container.

(9) Pour liquid contents of container into filter patch holder.

(10) Flush out all possible loose particles which may still be in container by pouring some solvent (PWC11-048) into it, shaking, then emptying into filter patch holder.

(11) Remove filter patch from filter patch holder and place in patch receptacle. Identify sample with type of filter, engine serial number and flight hours run.

(12) If any debris is found, particles large enough to be trapped by filter patch, should be sent to laboratory for material spectrographic analysis.

NOTE: Some operators retain the filter patches to establish a visual coloration trend. Operators doing this, need to build up their own experience for patch coloration trend evaluation because trends may vary from one engine to another and may be affected by the operating environment and maintenance practices.

(13) Remove plugs from filter element. Make sure the preformed packing does not drop inside the element).

WARNING: WHEN USING COMPRESSED AIR FOR DRYING, REGULATE TO 29 psi (200 kPa) OR LESS. WEAR GOGGLES OR FACE SHIELD TO PROTECT EYES.

(14) Dry filter element with clean compressed air at 29 psi (200 kPa).

(15) Install filter element on engine (Ref. Removal/Installation).

D. Debris in Oil System Inspection (Chip Detector and/or Oil Filter Bypass Warning)

NOTE: This procedure should be used in conjunction with Debris in Oil Fault Isolation Chart (Ref. Chapter 72-00-00, FAULT-ISOLATION-1)

(1) Confirmed oil filter bypass requires engine removal.

NOTE: An assessment of the amount of contamination can indicate whether a bypass has actually occurred. If the oil filters are replaced at regular intervals and debris is found deposited on most of the filter element surface, associated housing, chip detector and strainer, it can be considered that a bypass has occurred.

(2) Remove and inspect chip detector and filters. Use a magnet and determine if any of the debris collected is magnetic. If magnetic debris is found, use a magnifying glass and inspect. Analysis debris and take action required (Ref. Subpara. B.).

(3) Do a patch-making procedure (Ref. Subpara. C.) on relevant filter and transfer any debris from chip detector (Ref. Subpara. E.). Send filter patch and/or tape with chip detector debris for laboratory analysis (Ref. Subpara. B.)

(4) If allowable debris is found (Ref. Subpara. B., (2)), replace pressure oil filter, clean and reinstall chip detector strainer and chip detector. The aircraft may be returned to normal operation.

(5) If non-allowable debris category 1 is found (Ref. Subpara. B., (3)), remove the engine

(6) If non-allowable category 2 or 3 debris is found (Ref. Subpara. B.,(4) or (5)), and the engine has no history of generating debris within 400 flight hours, proceed as follows:

(a) Clean and install chip detector, associated strainer and replace oil filter.

(b) Run engine at 80% TO power for 10 minutes.

(c) Remove and inspect chip detector and oil filter.

(d) If no debris is found:

1 Clean and reinstall chip detector and oil filter.

2 Return engine to service.

3 Remove and inspect main oil filter after 50 flight hours.

(e) If debris is found:

1 Drain, flush and refill the engine oil system.

2 Clean and install chip detector and replace oil filter.

3 Run engine at 80% TO power for 10 minutes.

4 Remove and inspect chip detector(s) and oil filter. If no debris is found, install chip detector and oil filter and return engine to service. Remove and inspect oil filter after 50 flight hours. If debris is found, replace engine.

(7) If non-allowable category 2 or 3 debris is found (Ref. Subpara. B.,(4) or (5)), and the engine has a history, within 400 flight hours, of generating debris, proceed as follows:

(a) Review the results of last laboratory analysis.

NOTE: Results of last sample MUST be known prior to continuing operation.

(b) If results show bearing material (Ref. Subpara. B.(6)), remove engine.

(c) If results show gear (Ref. (7)) or any other ferrous material and quantity of debris is not increasing and the engine is not consistently generating debris, install chip detector and filter. Return engine to service. Remove and inspect oil filter for debris after engine has run for 50 flight hours. If amount of debris is increasing, replace engine at first opportunity within 10 flight hours.

NOTE: If the debris is generated by the accessory gearbox module, this may be replaced rather than the whole engine

(8) If non-magnetic debris is found, refer to Subpara. B., (8) for disposition.

E. Chip Detector Collected Debris Transfer

(1) Remove chip detector.

(2) Dip magnet end in solvent (PWC11-027) to remove oil.

(3) Transfer debris at magnet end to clear adhesive tape.

(4) Identify tape with engine serial number and hours run since new or overhauled.

(5) Send debris for analysis (Ref. Subpara. B.)

(6) Install chip detector.

10. Cleaning/Painting

A. Oil Filter Bypass Valve and Pressure Adjusting Valve

CAUTION: DO NOT EXTEND, CONTRACT, BEND OR OTHERWISE DAMAGE OIL FILTER BYPASS VALVE SPRING.

(1) Wash parts in clean petroleum solvent (PWC11-027). If necessary, use a nylon bristle brush to remove contaminants.

(2) Dry parts using clean, dry, filtered compressed air blast, or allow parts to stand and air dry.

11. Fits, Clearances and Torque Loadings

TABLE 201, Fits and Clearances

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
	NOT APPLICABLE					

TABLE 202, Torque and Stretch

REF. NO.	Name	Limits Min.	Limits Max.
3701	Oil Pressure Tube Assembly Coupling Nut		
	(1) Tighten and torque nut 400 to 450 lb.in. (45.2-50.8 Nm)		
3703	Bolt-Machine		
	(1) Tighten bolts to a torque of 36 to 40 lb.in. (4.1 to 4.5 Nm)		
3704	Bolt-Machine		
	(1) Tighten bolts to a torque of 20 to 30 lb.in. (2.3 to 3.4 Nm)		

TABLE 203, Spring Pressure

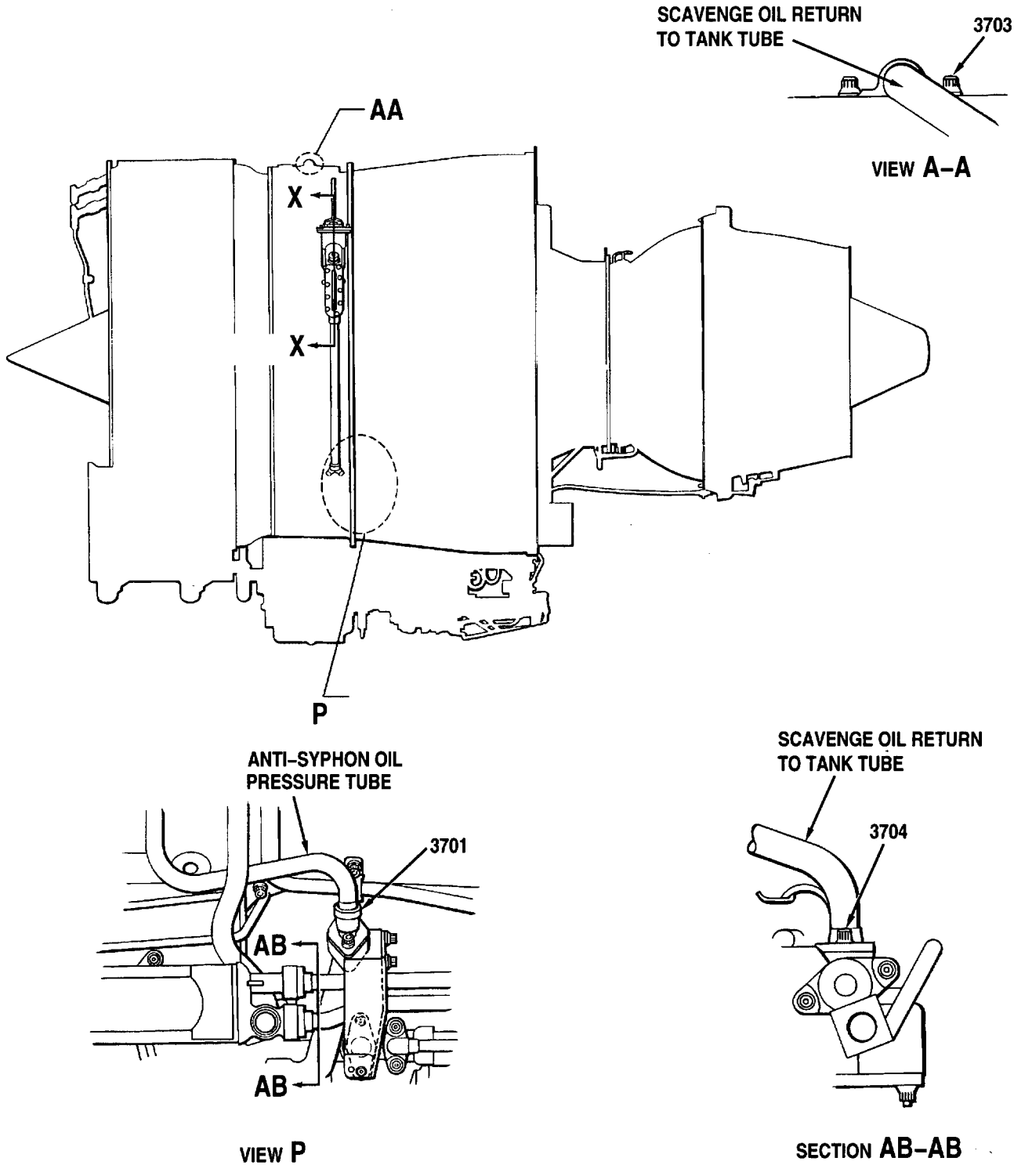
REF. NO.	Name	Limits Min.	Limits Max.
751	Spring, Oil Filter Bypass Valve		
	At length 1.777 (45.14)	2 lb 5 oz (10.3N)	3 lb 4 oz (14.5N)
	At length 1.222 (31.04)	10 lb 0 oz (44.6N)	11 lb 14 oz (52.9N)
752	Spring, Oil Filter Check Valve		
	At length 0.920 (23.37)	1 lb 14 oz (8.4N)	2 lb 2 oz (9.5N)
	At length 0.670 (17.02)	2 lb 10 oz (11.7N)	2 lb 14 oz (12.8N)

TABLE 204, Special Assembly Procedures

REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		

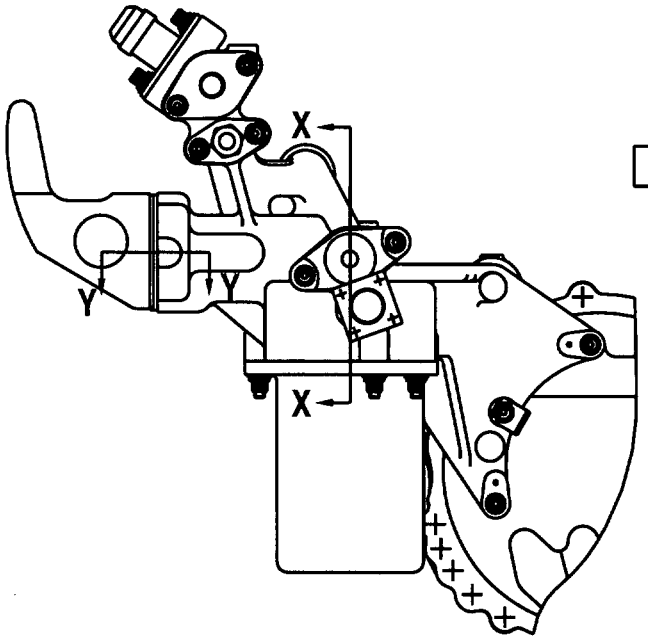
TABLE 205, Backlash

REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		

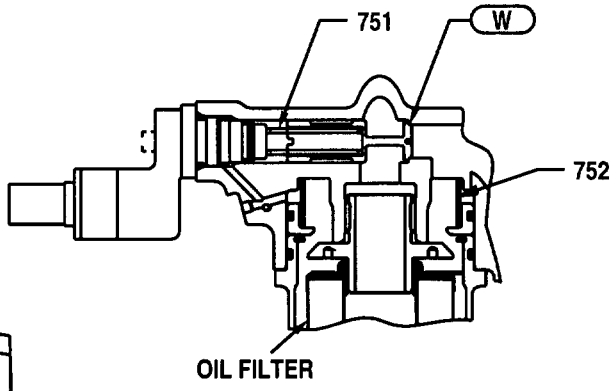


C33813

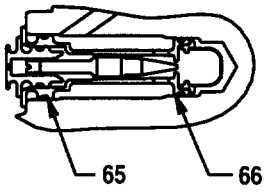
Oil System - Fits, Clearances and Torque Loadings
Figure 207 (Sheet 1 of 2)



VIEW ON REAR OF
OIL FILTER HOUSING



SECTION X-X



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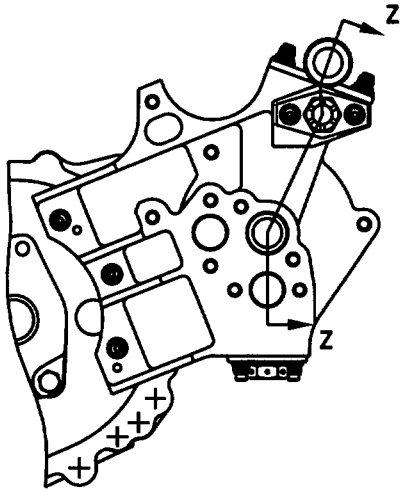
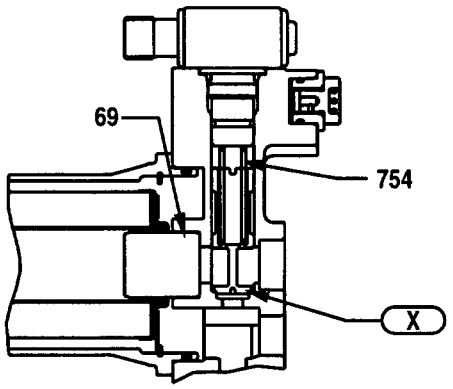


VIEW W



SECTION Z-Z

C33815

Oil System - Fits, Clearances and Torque Loadings
Figure 207 (Sheet 2)

FUEL/OIL HEAT EXCHANGER - MAINTENANCE PRACTICES

1. General

   A. Use engine oil to lubricate preformed packings, threads and mating surfaces, unless otherwise stated.

   B. Lubricate preformed packings in fuel system with engine fuel.

   C. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after sub-assembly.

2. Consumable Materials

   Not Applicable

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Fuel/Oil Heat Exchanger

   A. Removal (Ref. Fig. 201)

      (1) Drain oil system (Ref. 72-00-00, SERVICING).

      (2) Remove three nuts (4) and washers (3).

      (3) Pre-SB24555:

         (a) Remove two bolts (6) and bracket (9) that attach the fuel tube (11) to fuel/oil heat exchanger (8).

         (b) Remove two bolts (6) that attach the fuel tube (7) to fuel/oil heat exchanger (8).

      (4) Post-SB24555:

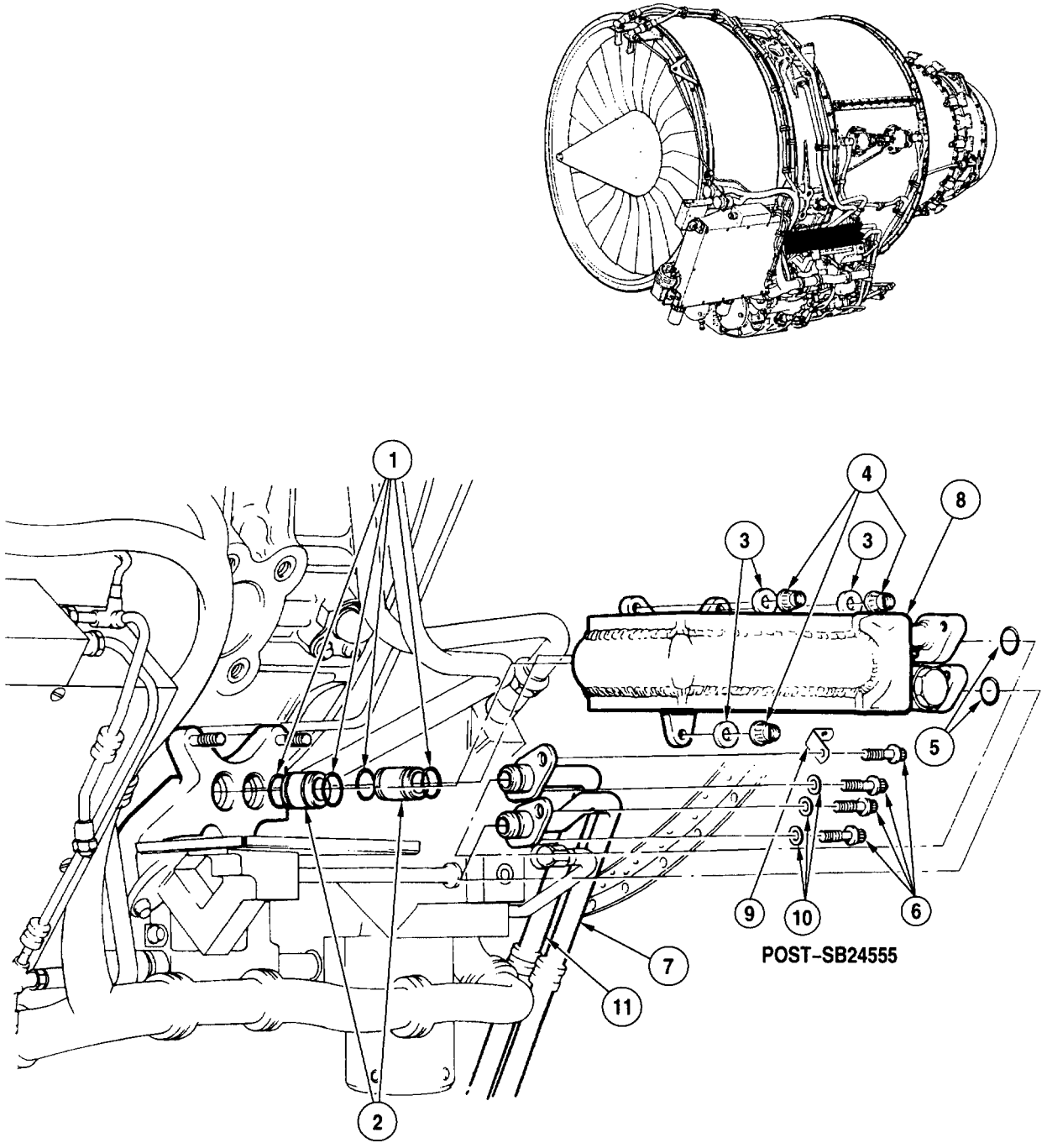
         (a) Remove two bolts (6), washer (10) and bracket (9) that attach the fuel tube (11) to fuel/oil heat exchanger (8).

         (b) Remove two bolts (6) and two washers that attach the fuel tube (7) to fuel/oil heat exchanger (8).

      (5) Spring-back fuel tubes (7 and 11) and remove heat exchanger from engine. Discard preformed packings (5).

      (6) Remove transfer tubes (2) and discard preformed packings (1).

      (7) Install protective caps and/or plugs in all openings.



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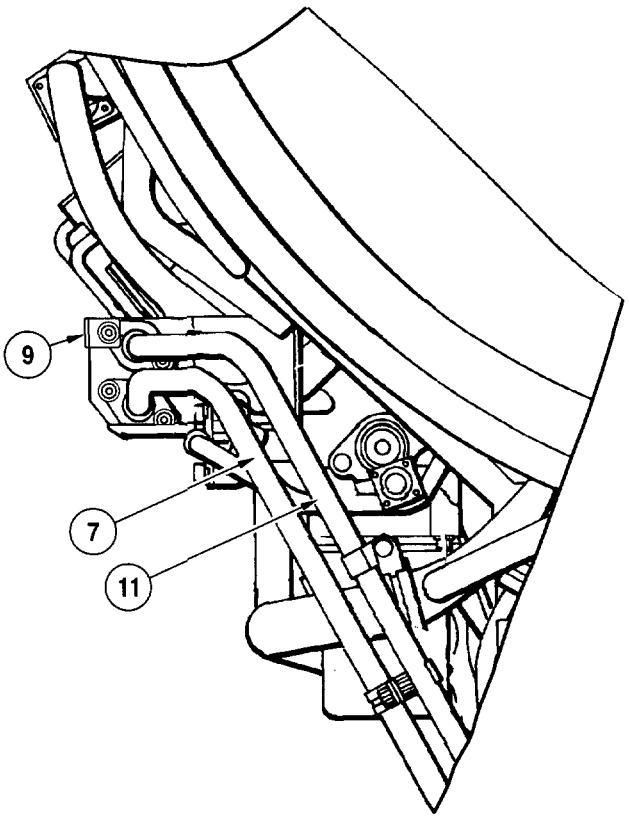
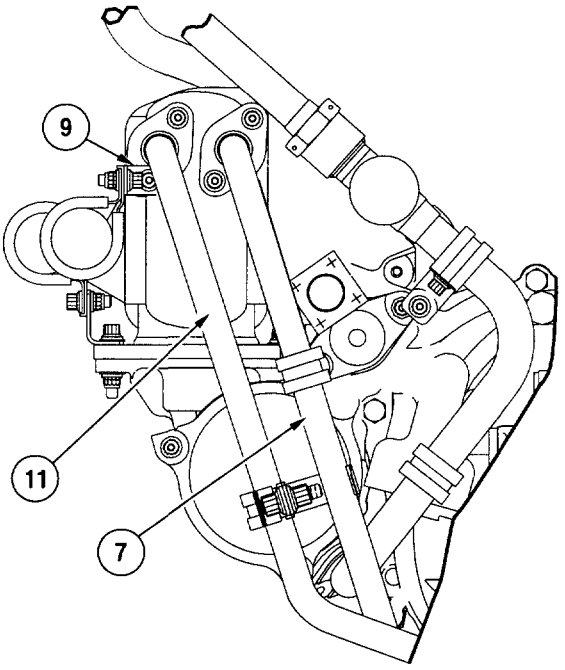
Fuel/Oil Heat Exchanger - Removal/Installation
Figure 201 (Sheet 1 of 2)

Key to Figure 201

1. Preformed Packing
2. Transfer Tube
3. Washer
4. Self-locking Nut
5. Preformed Packing
6. Bolt
7. Fuel Tube (Heater to Filter)
8. Fuel/Oil Heat Exchanger
9. Bracket
10. Washer (Post-SB24555)
11. Fuel Tube (HMU to Heater)



PRE-SB24367



POST-SB24367

C113941

Fuel/Oil Heat Exchanger - Removal/Installation
Figure 201 (Sheet 2)

B. Installation (Ref. Fig. 201)

(1) Remove all protective caps and/or plugs.

(2) Install new preformed packings (1) on transfer tubes (2).

(3) Install new preformed packings (5) on fuel tubes (7 and 11).

(4) Insert transfer tubes (2) into oil manifold.

CAUTION: DO NOT LUBRICATE THREADS.

CAUTION: MAKE SURE HEAT EXCHANGER IS FULLY SEATED ON OIL PRESSURE MANIFOLD BEFORE TIGHTENING NUTS. DO NOT USE NUTS TO FORCE HEAT EXCHANGER INTO POSITION.

(5) Install heat exchanger (8) on studs and attach with three washers (3) and nuts (4). Tighten and torque nuts 27 to 30 lb.in. (3.0-3.4 Nm) using an opposing pattern.

(6) Pre-SB24555:

(a) Attach fuel tube (11) to fuel/oil heat exchanger (8) with bracket (9) and two bolts (6). Tighten and torque 36 to 40 lb.in. (4.0-4.6 Nm).

NOTE: Install bracket with the long leg on flange.

(b) Attach fuel tube (7) to fuel/oil heat exchanger (8) with two bolts (6). Tighten and torque 36 to 40 lb.in. (4.0-4.6 Nm).

(7) Post-SB24555:

(a) Attach fuel tube (11) to fuel/oil heat exchanger (8) with bracket (9), washer (10) and two bolts (6). Tighten and torque 36 to 40 lb.in. (4.0-4.6 Nm).

NOTE: Install bracket with the long leg on flange.

(b) Attach fuel tube (7) to fuel/oil heat exchanger (8) with two washers (10) and two bolts (6). Tighten and torque 36 to 40 lb.in. (4.0-4.6 Nm).

(8) Refer to Chapter 71-00-00 for checks following installation of fuel/oil heat exchanger.

6. Oil Pressure Manifold Assembly

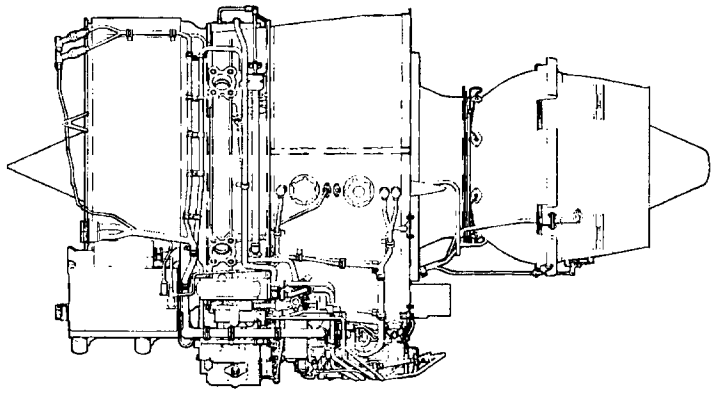
A. Removal (Ref. Fig. 202)

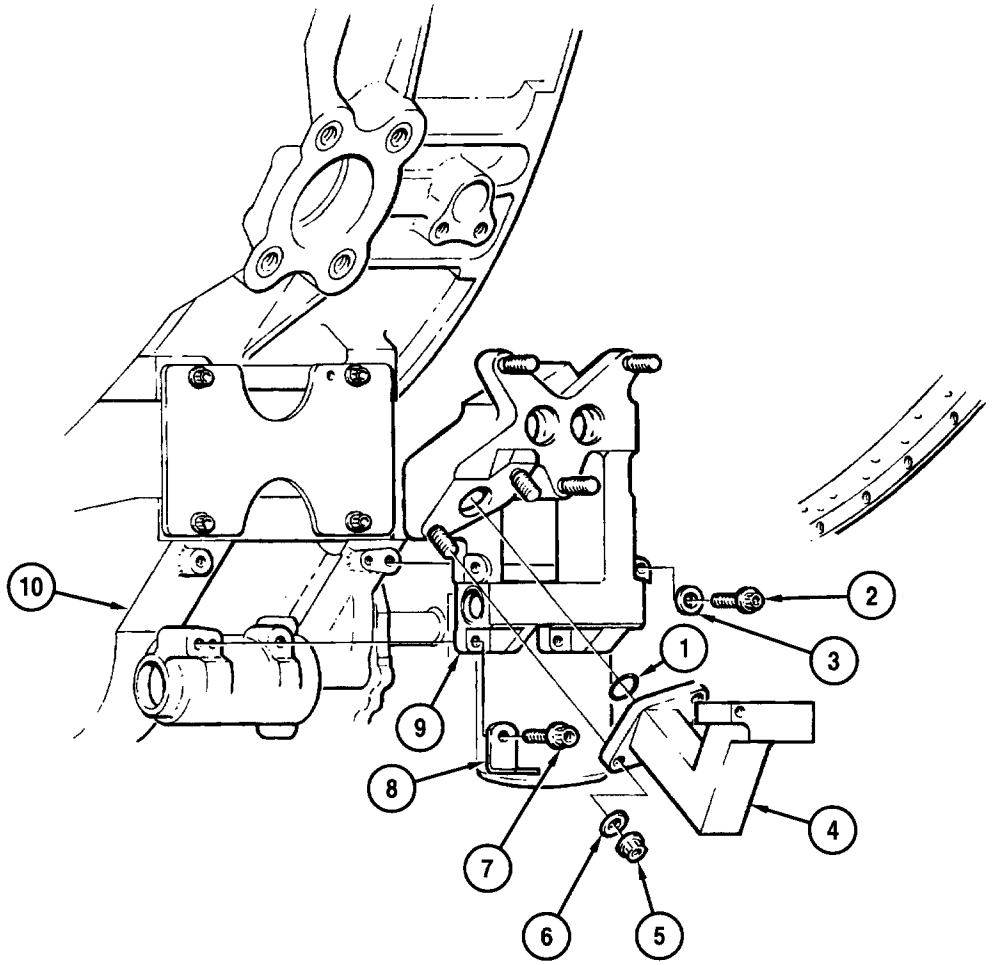
(1) Remove two nuts (5) and washers (6) and remove manifold elbow (4) from oil pressure manifold (9).

(2) Remove and discard preformed packing (1).

(3) Support oil pressure manifold (9) and remove four bolts (2, 7), three washers (3) and bracket (8). Remove oil pressure manifold from accessory gearbox (10).

(4) Place protective covers on all oil pressure manifold openings.





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Oil Pressure Manifold Assembly - Removal/Installation
Figure 202

Key to Figure 202

1. Preformed Packing
2. Bolt
3. Washer
4. Manifold Elbow
5. Nut
6. Washer
7. Bolt
8. Bracket
9. Oil Pressure Manifold
10. Accessory Gearbox (Ref.)

(5) Place all removed parts in sealable plastic bags and identify with names and part numbers of contents.

B. Installation (Ref. Fig. 202)

(1) Locate oil pressure manifold assembly (9) on two dowel pins on accessory gearbox (10) and secure with three washers (3) and bolts (2). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(2) Install bracket (8) over remaining oil pressure manifold mounting hole and secure with bolt (7). Torque bolt 36 to 40 lb.in. (4.0-4.6 Nm).

(3) Lubricate new preformed packing (1) and install on manifold elbow assembly (4).

(4) Install manifold elbow assembly (4) on oil pressure manifold (9) and secure with two washers (6) and nuts (5). Torque nuts 27 to 30 lb.in. (3.0-3.4 Nm).

(5) Install two slave guide pins (0.190 - 32) into oil pressure manifold and one slave guide pin (0.190 - 32) into accessory gearbox cover, to facilitate installation of oil filter housing assembly.

SCAVENGE OIL TUBES - MAINTENANCE PRACTICES

1. General

   A. Use engine oil to lubricate preformed packings, threads and mating surfaces, unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after sub-assembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-089	Lockwire or Safetywire, Nickel Alloy (CRES)
PWC11-021	Compound, Carbon Remover
PWC11-027	Solvent, Petroleum

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Scavenge Oil Return to Tank Tube Assembly

   A. Removal (Ref. Fig. 201)

      (1) Remove two nuts (5), bolts (1) and loop clamps (4) securing scavenge oil return tube assembly (3) to intermediate case and anti-syphon tube.

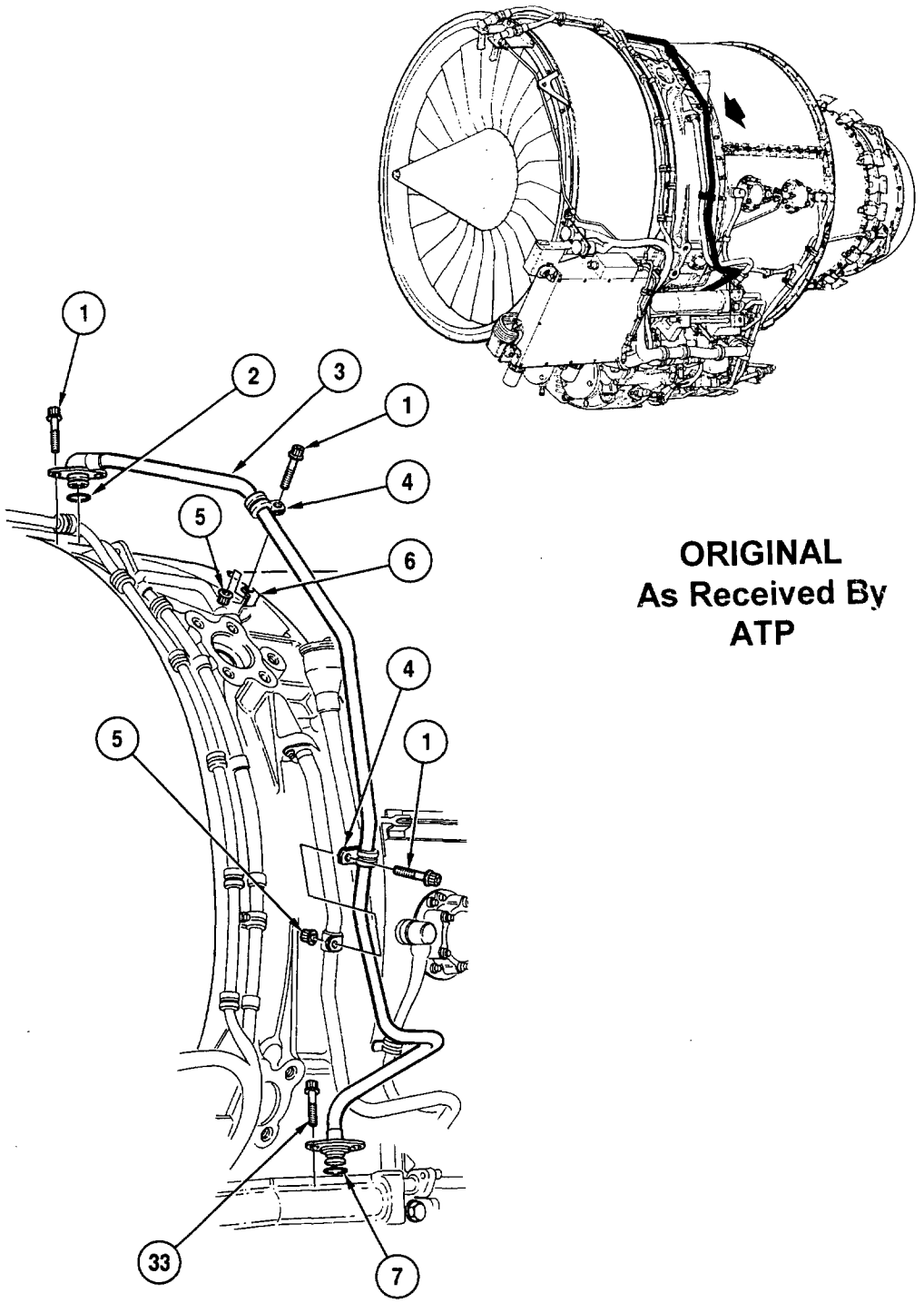
      (2) Remove two bolts (1) at flange on top of intermediate case and two bolts (1) at oil filter housing and remove scavenge oil return tube assembly (3).

      (3) Remove and discard preformed packings (2, 7). Place protective covers on tube (3).

   B. Installation (Ref. Fig. 201)

      (1) Lubricate two new preformed packings (2, 7) with engine oil (PWC03-001) and install on scavenge oil return to tank tube (3).

      (2) Install scavenge oil tube (3) to boss on intermediate case, and to oil filter housing and secure with bolts (1 and 33). Torque bolts (1) 36 to 40 lb.in. (4.1-4.5 Nm), and bolts (33) 20 to 30 lb.in. (2.3-3.4 Nm).



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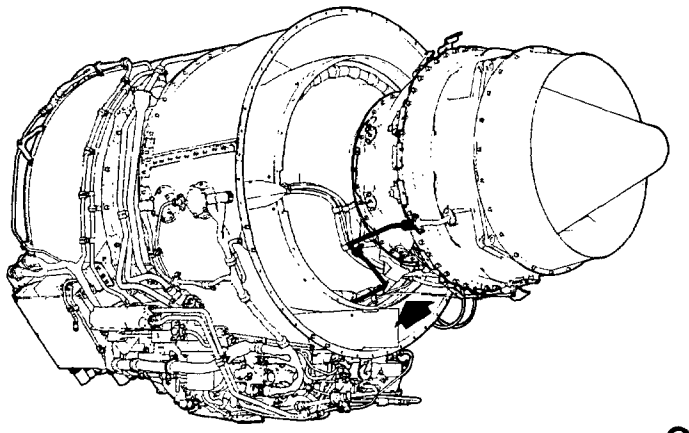
ATP

C19989B

Scavenge Oil Tubes - Removal/Installation
Figure 201 (Sheet 1 of 3)

Key to Figure 201

1. Bolt
2. Preformed Packing
3. Scavenge Oil Tube (return to tank)
4. Loop Clamp
5. Self-locking Nut
6. Bracket
7. Preformed Packing
8. Metal Gasket
9. Preformed Packing
10. Self-locking Nut
11. Loop Clamp
12. Preformed Packing
13. Bolt
14. Bolt
15. Scavenge Oil Tube (No. 4 Bearing)
16. Preformed Packing
17. Bolt
18. Scavenge Oil Tube (No. 3 Bearing)
19. Loop Clamp
20. Scavenge Oil Tube (No. 4 Bearing)
21. Preformed Packing
22. Bolt
23. Preformed Packing
24. Flat Washer
25. Elbow
26. Retaining Ring
27. Transfer Tube
28. Preformed Packing
29. Elbow (Ref.)
30 Bolt
31 Nut
32 Loop Clamp
33 Bolt



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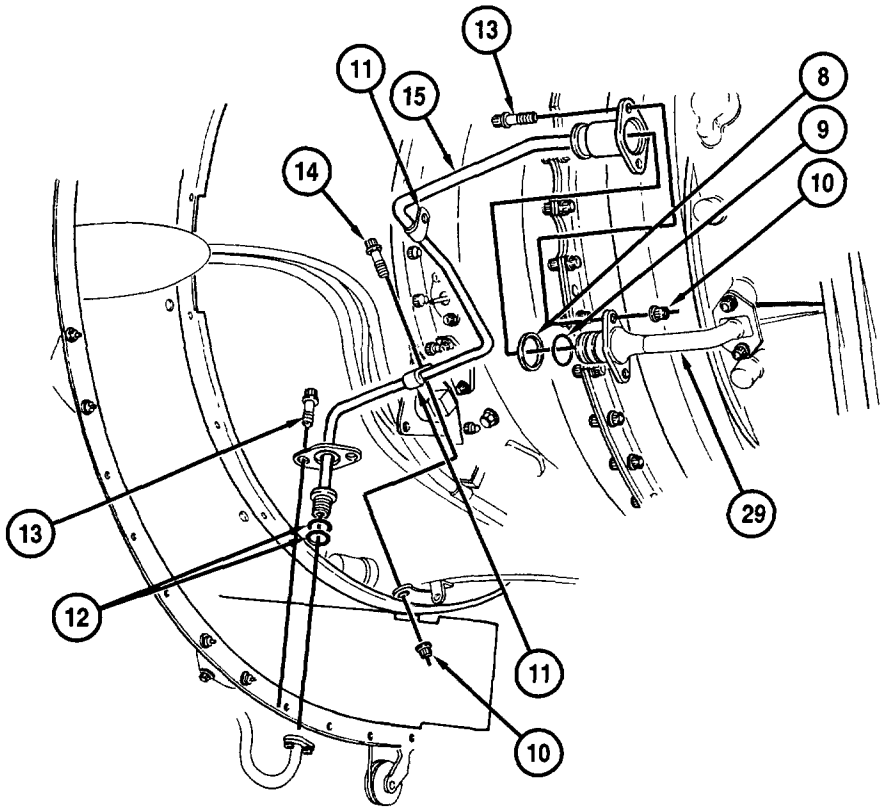
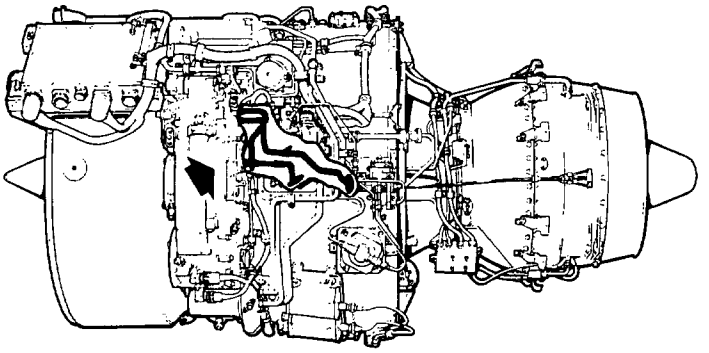


C19990A

Scavenge Oil Tubes - Removal/Installation
Figure 201 (Sheet 2)



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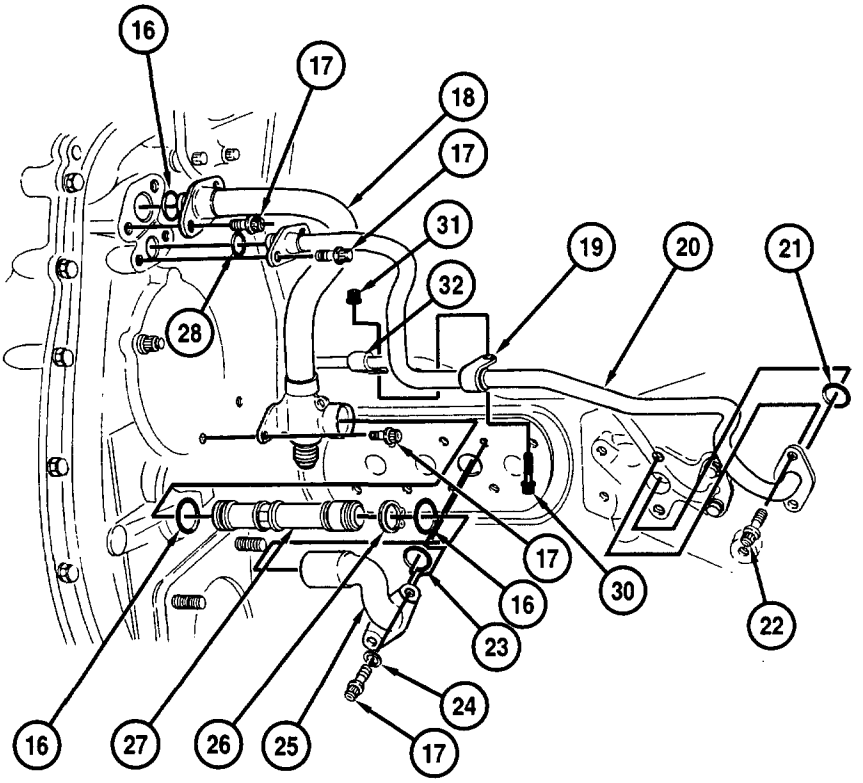

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Scavenge Oil Tubes - Removal/Installation
Figure 201 (Sheet 3)

CAUTION: DO NOT LUBRICATE THREADS OF BOLTS (1) SECURING LOOP CLAMPS (4).

(3) Install loop clamps (4) on scavenge oil tube (3) and secure to bracket (6), and to loop clamp on anti-syphon tube assembly with bolts (1) and nuts (5). Torque nuts 27 to 30 lb.in. (3.0-3.4 Nm).

6. No. 4 Bearing Scavenge Oil Tube Assembly

A. Removal (Ref. Fig. 201)

(1) Remove nut (10), bolt (14) and loop clamp (11) securing No. 4 bearing scavenge oil tube assembly (15) to bracket on Flange E.

(2) Remove nut (10), bolt (14) and remaining loop clamp (11).

(3) Remove two bolts (13) at outer bypass duct and two nuts (10) and bolts (13) at flange on elbow (29) and remove No. 4 bearing scavenge oil tube assembly (15) and gasket (8). Discard gasket.

(4) Remove four preformed packings (9, 12). Discard preformed packings. Place protective covers on tube ends.

B. Installation (Ref. Fig. 201)

(1) Lubricate two new preformed packings (9) with engine oil (PWC03-001) and install on elbow (29). Install new metal gasket (8) on elbow (29).

(2) Lubricate two new preformed packings (12) and install on No. 4 bearing scavenge oil tube assembly (15).

CAUTION: DO NOT LUBRICATE THREADS OF BOLTS (13) AT ELBOW (29).

(3) Install No. 4 bearing scavenge oil tube (15) to elbow (29) with two bolts (13) and nuts (10). Torque nuts 27 to 30 lb.in. (3.0-3.4 Nm).

(4) Secure lower end of oil tube assembly (15) to outer bypass duct with two bolts (13). Torque bolts 20 to 30 lb.in. (2.2-3.4 Nm).

CAUTION: DO NOT LUBRICATE THREADS OF BOLTS (14).

(5) Secure oil tube assembly (15) to bracket on flange E with loop clamp (11), bolt (14) and nut (10). Torque nut 27 to 30 lb.in. (3.0-3.4 Nm).

(6) Secure oil tube assembly (15) to bracket on pressure oil tube assembly with bolt (14) and nut (10). Torque nut (10) and nut (17) 27 to 30 lb.in. (3.0-3.4 Nm).

7. No. 4 Bearing Scavenge Oil Tube Assembly - AGB to Outer Bypass Duct

A. Removal (Ref. Fig. 201)

(1) Remove nut (10), bolt (13) and loop clamp (19).

(2) Remove two bolts (17). Remove lockwire and remove two bolts (22) and scavenge oil tube assembly (20).

(3) Remove and discard preformed packings (21, 28). Place protective covers on tube ends.

B. Installation (Ref. Fig. 201)

(1) Lubricate two new preformed packings (16, 21) with engine oil (PWC03-001) and install on No. 4 bearing scavenge oil tube assembly (20).

(2) Install scavenge oil tube assembly (20) to boss on accessory gearbox and secure with two bolts (17), and to boss on outer bypass duct and secure with two bolts (22). Torque bolts (17) 36 to 40 lb.in. (4.0-4.6 Nm), and bolts (22) 20 to 30 lb.in. (2.2-3.2 Nm).

CAUTION: DO NOT LUBRICATE THREADS OF BOLT (30).

(3) Install loop clamp (19) on tube assembly (20) and secure to loop clamp (32) with bolt (30) and nut (31). Torque nut 27 to 30 lb.in. (3.0-3.4 Nm).

8. No. 3 Bearing Scavenge Oil Tube Assembly

A. Removal (Ref. Fig. 201)

(1) Remove two bolts (17) and washers (24), securing elbow (2) to boss on outer bypass duct.

(2) Remove elbow (25) and transfer tube (27) as an assembly. Remove and discard preformed packings (16, 23).

(3) Remove retaining ring (26) and separate transfer tube (27) from elbow (25). Remove and discard preformed packing (16). Place protective covers on tube ends.

(4) Remove lockwire and disconnect coupling nut on differential pressure switch tube assembly from scavenge oil tube assembly (18).

(5) Remove four bolts (17) and scavenge oil tube assembly (18). Remove and discard preformed packing (16). Place protective covers on tube ends.

B. Installation (Ref. Fig. 201)

(1) Lubricate new preformed packing (28) and install on scavenge oil tube assembly (18).

(2) Install scavenge oil tube (18) on accessory gearbox and secure at two places with four bolts (17). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(3) Place retaining ring (26) over transfer tube (27).

(4) Lubricate two new preformed packings (16) and install on transfer tube (27).

(5) Install transfer tube (27) in elbow (25). Do not secure with retaining ring (26) at this time.

(6) Lubricate new preformed packing (23) and install on elbow (25).

(7) Install elbow (25) on bypass duct boss and secure with two washers (24) and bolts (17). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(8) Slide transfer tube (27) into scavenge oil tube (18) and engage retaining ring (26) in elbow (25).

(9) Connect coupling nut of differential pressure switch tube assembly (Ref. 79-30-02) to tee connection of scavenge oil tube (18). Torque coupling nuts of tube 90 to 100 lb.in. (10-11 Nm) and lockwire (PWC05-089).

9. Inspection/Check

NOTE: For periodic inspection refer to Chapter 5-20-00.

A. Scavenge Oil Tubes

(1) Cracks - Cracked tubing must be replaced. No repair is permitted.

(2) Scratches - Minor scratches having no appreciable depth are acceptable. Scratches to a depth of 0.005 inch (0.13 mm) must be blended out. Replace tubing with scratches over 0.005 inch (0.13 mm) inch deep.

(3) Nicks - Individual nicks up to 0.062 inch (11.58 mm) long by 0.010 inch (0.25 mm) wide and 0.003 inch (0.08 mm) deep can be ignored. Nicks to a maximum depth of 0.005 inch (0.13 mm) must be blended out to remove sharp edges. Replace tubing with nicks greater than 0.005 inch (0.13 mm) deep.

(4) Dents - Round bottom dents on straight sections of tubing are permitted provided the length and depth are not greater than 10 percent of the normal outside diameter of tube. No more than one dent to maximum depth per 12 inch (30.5 cm) length of tube is acceptable. Dents on tube bends, which cause restriction by flattening and local weakening, are not acceptable.

(5) Pitting - Minor isolated pitting up to 0.003 inch (0.08 mm) deep is acceptable. Clusters of pitting should be blended out to a maximum depth of 0.005 inch (0.13 mm). Tubing must be replaced if pitting exceeds 0.005 inch (0.13 mm) deep.

(6) Corrosion - Straining on tubing and surface corrosion is acceptable if removable by light polishing with crocus cloth and oil.

10. Cleaning/Painting

A. Scavenge Oil Tubes

(1) Soak external oil tubing in cold carbon remover compound (PWC11-021) for two hours at room temperature.

(2) Remove tube from solvent and pull a suitable sized swab (or lint-free cloth) through tube.

CAUTION: ENSURE NO PART OF SWAB OR CLOTH REMAINS IN OIL TUBE; OTHERWISE, OIL FLOW CAN BE RESTRICTED.

(3) Rinse tube exterior with petroleum solvent.

(4) Pressure flush tube interior with petroleum solvent (PWC11-027) and dry interior and exterior with compressed air.

PRESSURE OIL TUBES - MAINTENANCE PRACTICES

1. General

   A. Use engine oil to lubricate preformed packings, threads and mating surfaces, unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after sub-assembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC05-089	Lockwire or Safetywire, Nickel Alloy (CRES)
PWC11-021	Compound, Carbon Remover
PWC11-027	Solvent, Petroleum

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Anti-Syphon Pressure Oil Tube Assembly

   A. Removal (Ref. Fig. 201)

      (1) Remove lockwire and remove two bolts (1) at anti-syphon unit boss.

      (2) Disconnect anti-syphon pressure oil tube assembly (2) at the oil pressure manifold, and remove anti-syphon pressure oil tube assembly.

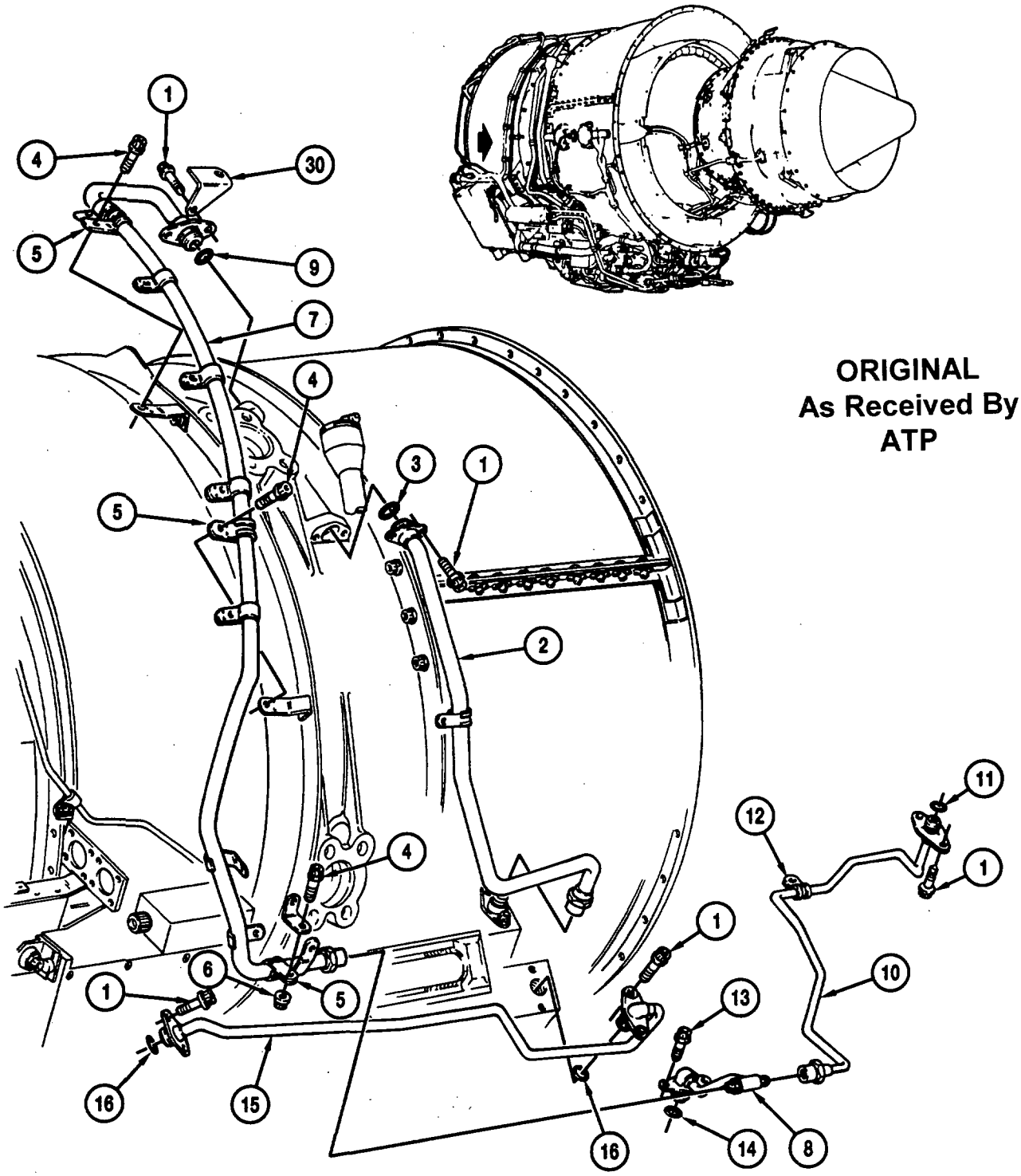
      (3) Remove and discard preformed packing (3). Place protective covers on tube ends.

   B. Installation (Ref. Fig. 201)

      (1) Lubricate new preformed packing (3) and install on anti-syphon pressure oil tube assembly (2).

      (2) Install pressure oil tube assembly (2) to boss on intermediate case and secure with two bolts (1). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

      (3) Install coupling nut of pressure oil tube (2) to adapter on oil pressure manifold. Torque coupling nut (Fits and Clearances REF. NO. 3701).



Oil Pressure Tubes - Removal/Installation
Figure 201 (Sheet 1 of 2)

Key to Figure 201

1. Bolt
2. Anti-Syphon Oil Pressure Tube Assembly
3. Preformed Packing
4. Bolt
5. Loop Clamp
6. Nut
7. AGB and No. 4 Bearing Oil Pressure Tube Assembly
8. AGB Oil Pressure Tube Assembly
9. Preformed Packing
10. No. 4 Bearing to Bypass Duct Oil Pressure Tube Assembly
11. Preformed Packing
12. Loop Clamp
13. Bolt
14. Preformed Packing
15. PAV to Pump Oil Pressure Tube Assembly
16. Preformed Packing
17. Nut
18. Bolt
19. Loop Clamp
20. Bracket
21. Bolt
22. Bracket
23. Bracket
24. Bolt
25. No. 4 Bearing Oil Pressure Tube Assembly
26. Gasket
27. Preformed Packing
28. Preformed Packing
29. Elbow (Ref.)

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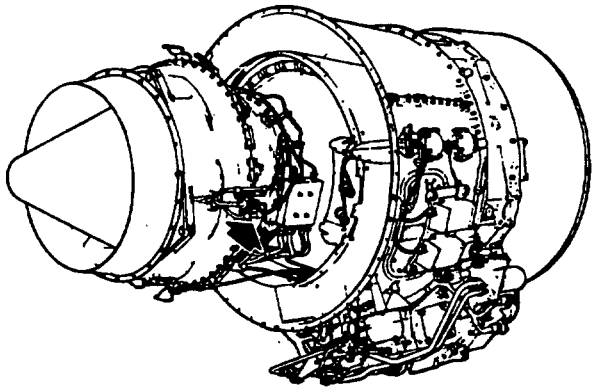

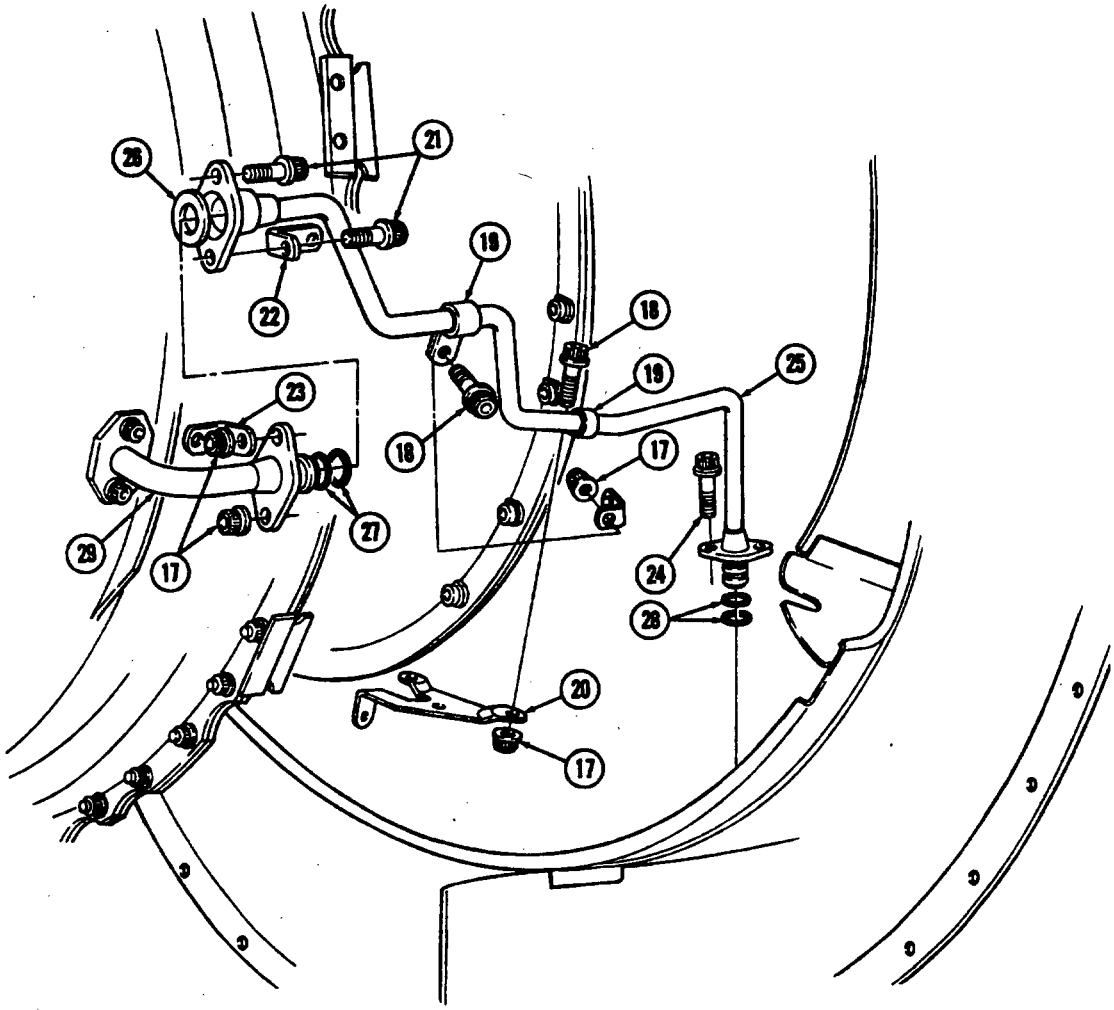

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Oil Pressure Tubes - Removal/Installation
Figure 201 (Sheet 2)

6. AGB and No. 4 Bearing Oil Pressure Tube Assembly

A. Removal (Ref. Fig. 201)

(1) Remove two bolts (4) securing loop clamps (5) to brackets on Flange B. Remove loop clamps (5) from tube (7).

(2) Remove nut (6), bolt (4) and loop clamp (5) at lower end of AGB and No. 4 bearing oil pressure tube assembly (7).

(3) Remove two bolts (1) at flange on intermediate case. Cut lockwire and disconnect oil pressure tube assembly (7) from AGB oil pressure assembly (8). Remove oil pressure tube assembly (7).

(4) Remove and discard preformed packing (9). Place protective covers on tube ends.

B. Installation (Ref. Fig. 201)

(1) Lubricate new preformed packing (9) and install on pressure oil to AGB and No. 4 bearing tube assembly (7).

(2) Install tube assembly (7) to boss on intermediate case and secure with two bolts (1). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

(3) Connect lower end of tube assembly (7) to pressure oil to AGB tube assembly (8). Install coupling nut handtight.

(4) Install two loop clamps (5) on tube assembly (7) and secure to brackets on Flange B with two bolts (4). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

CAUTION: DO NOT LUBRICATE THREADS OF BOLT (4) AT LOWER LOOP CLAMP.

(5) Install loop clamp (5) on tube assembly (7) lower end and secure to bracket with bolt (4) and nut (6). Torque nut 27 to 30 lb.in. (3.0-3.4 Nm).

7. No. 4 Bearing to Bypass Duct Oil Pressure Tube Assembly

A. Removal (Ref. Fig. 201)

(1) Remove two bolts (1) at boss on outer bypass duct.

(2) Cut lockwire and disconnect No. 4 bearing to bypass duct oil pressure tube assembly (10) from AGB pressure oil tube assembly (8). Remove No. 4 bearing to bypass duct oil pressure tube assembly.

(3) Remove and discard preformed packing (11). Remove loop clamp (12).

(4) Place protective covers on tube ends.

B. Installation (Ref. Fig. 201)

(1) Lubricate new preformed packing (11) and install on No. 4 bearing to bypass duct pressure oil tube assembly (10).

(2) Install pressure oil tube assembly (10) to boss on outer bypass duct and secure with two bolts (1). Tighten bolts fingertight.

(3) Install coupling nut of pressure oil tube assembly (10) to AGB oil pressure tube assembly (8). Tighten coupling nut fingertight.

(4) Torque bolts (1) 20 to 30 lb.in. (2.2.-3.4 Nm).

(5) Hold AGB pressure oil tube assembly (8) and torque connector nut of pressure oil tube assembly (10) 90 to 100 lb.in. (10.0-11.5 Nm).

(6) Hold AGB pressure oil tube assembly (8) and torque connector nut of AGB and No. 4 bearing pressure oil tube assembly (7) 450 to 500 lb.in. (50.0-56.0 Nm).

(7) Lockwire (PWC05-089) coupling nuts of pressure oil tubes (7, 10) together.

(8) Install loop clamp (12) on pressure oil tube (10).

NOTE: Loop clamp (12) will be secured to loop clamp on scavenge oil tube assembly (20) at a later time.

8. AGB Oil Pressure Tube Assembly

A. Removal (Ref. Fig. 201)

(1) Remove two bolts (13) and AGB oil pressure tube assembly (8).

(2) Remove and discard preformed packing (14). Place protective covers on tube ends.

B. Installation (Ref. Fig. 201)

(1) Lubricate new preformed packing (14) and install on pressure oil to AGB tube assembly (8).

(2) Install tube assembly (8) to boss on AGB and secure with two bolts (13). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

9. PAV-to-Pump Tube Assembly

A. Removal (Ref. Fig. 201)

(1) Remove two bolts (1) at oil filter housing and two bolts (1) at oil pump and remove PAV-to-pump tube assembly (15).

(2) Remove and discard two preformed packings (16). Place protective covers on tube ends.

B. Installation (Ref. Fig. 201)

(1) Lubricate two new preformed packings (16) and install on PAV-to-pump tube assembly (15).

(2) Install tube assembly (15) on boss on pressure oil pump and boss on oil filter housing. Secure tube with four bolts (1). Torque bolts 36 to 40 lb.in. (4.0-4.6 Nm).

10. No. 4 Bearing Oil Pressure Tube Assembly

A. Removal (Ref. Fig. 201)

(1) Remove nut (17), bolt (18) and loop clamp (19) at flange F.

(2) Remove nut (17), bolt (18), bracket (20) and loop clamp (19).

(3) Remove two nuts (17), bolts (21) and brackets (22, 23) at elbow at flange F.

(4) Remove two bolts (24) at tube flange at outer bypass duct and remove No. 4 bearing oil pressure tube assembly (25).

(5) Remove and discard gasket (26) and preformed packings (27, 28). Place protective covers on tube openings.

B. Installation (Ref. Fig. 201)

(1) Lubricate two new preformed packings (27) and install on elbow (29). Install new gasket (26) on elbow (29).

(2) Lubricate two new preformed packings (28) and install on No. 4 bearing pressure oil tube assembly (25).

CAUTION: DO NOT LUBRICATE THREADS OF BOLT (21).

(3) Install oil tube assembly (25) on elbow (29) and secure with two bolts (21), brackets (22, 23) and nuts (17). Torque nuts 27 to 30 lb.in. (3.0-3.4 Nm).

(4) Install remaining flange of oil tube assembly (25) on boss on outer bypass duct and secure with two bolts (24). Torque bolts 20 to 30 lb.in. (2.2-3.4 Nm).

CAUTION: DO NOT LUBRICATE THREADS OF BOLT (18).

(5) Install loop clamp (19) on oil tube assembly (25) and secure to bracket on flange E with bolt (18) and nut (17). Torque nut 27 to 30 lb.in. (3.0-3.4 Nm).

CAUTION: DO NOT LUBRICATE THREADS OF BOLT (18).

(6) Install loop clamp (19) on oil tube assembly (25) and secure to bracket (20) with bolt (18) and nut (17). Tighten nut fingertight.

NOTE: Nut (17) will be torque tightened after No. 4 bearing scavenge oil tube assembly is secured to bracket (20).

11. Inspection/Check

A. Pressure Oil Tubes

(1) Cracks - Cracked tubing must be replaced. No repair is permitted.

(2) Scratches - Minor scratches having no appreciable depth are acceptable. Scratches to a depth of 0.005 inch (0.13 mm) must be blended out. Replace tubing with scratches over 0.005 inch (0.13 mm) inch deep.

(3) Nicks - Individual nicks up to 0.062 inch (11.58 mm) long by 0.010 inch (0.25 mm) wide and 0.003 inch (0.08 mm) deep can be ignored. Nicks to a maximum depth of 0.005 inch (0.13 mm) must be blended out to remove sharp edges. Replace tubing with nicks greater than 0.005 inch (0.13 mm) deep.

(4) Dents - Round bottom dents on straight sections of tubing are permitted provided the length and depth are not greater than 10 percent of the normal outside diameter of tube. No more than one dent to maximum depth per 12 inch (30.5 cm) length of tube is acceptable. Dents on tube bends, which cause restriction by flattening and local weakening, are not acceptable.

(5) Pitting - Minor isolated pitting up to 0.003 inch (0.08 mm) deep is acceptable. Clusters of pitting should be blended out to a maximum depth of 0.005 inch (0.13 mm). Tubing must be replaced if pitting exceeds 0.005 inch (0.13 mm) deep.

(6) Corrosion - Staining on tubing and surface corrosion is acceptable if removable by light polishing with crocus cloth and oil.

12. Cleaning/Painting

A. Pressure Oil Tubes

(1) Soak external oil tubing in cold carbon remover compound (PWC11-021) for two hours at room temperature.

(2) Remove tube from solvent and pull a suitable sized swab (or lint-free cloth) through tube.

CAUTION: ENSURE NO PART OF SWAB OR CLOTH REMAINS IN OIL TUBE; OTHERWISE, OIL FLOW CAN BE RESTRICTED.

(3) Rinse tube exterior with petroleum solvent (PWC11-027).

(4) Pressure flush tube interior with petroleum solvent and dry interior and exterior with compressed air.

13. Fits, Clearances and Torque Loadings

TABLE 201, Fits and Clearances

REF. NO.	Name	Dim. for Ref. inches (mm) Min.	Dim. for Ref. inches (mm) Max.	Limits inches (mm) Min.	Limits inches (mm) Max.	Limits inches (mm) Replace
NOT APPLICABLE						

TABLE 202, Torque and Stretch

REF. NO.	Name	Limits Min.	Limits Max.
3701	Oil Pressure Tube Assembly Coupling Nut		
	(1) Tighten and torque nut 400 to 450 lb.in. (45.2-51.0 Nm).		

TABLE 203, Spring Pressures

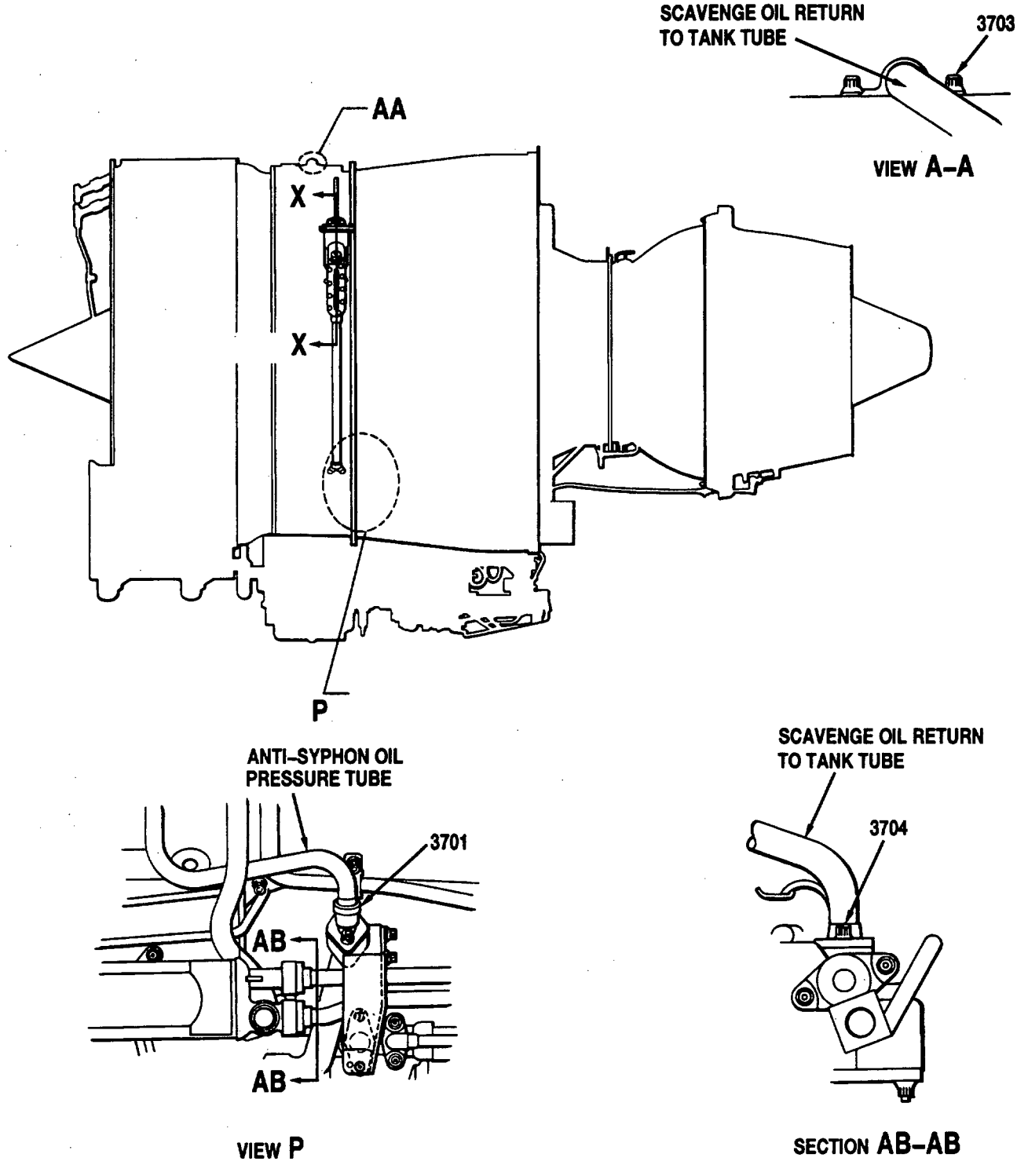
REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		

TABLE 204, Special Assembly Procedures

REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		

TABLE 205, Backlash

REF. NO.	Name	Limits Min.	Limits Max.
	NOT APPLICABLE		



Pressure Oil Tubes - Fits and Clearances
Figure 202

OIL PUMP ASSEMBLY - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors afterdisassembly.

2. Consumable Materials

   The consumable materials listed below are identified in procedural text.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name	Remarks
PWC03-001	Oil, Engine Lubricating	

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC43172	Puller
PWC60831	Fixture

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Removal/Installation

   A. Removal of Oil Pump Assembly (Pre-SB24367) (Ref. Fig. 201)

      (1) Drain oil system (Ref. 72-00-00, SERVICING).

      (2) Remove EEC and lower electrical bracket assembly (Ref. 73-20-02).

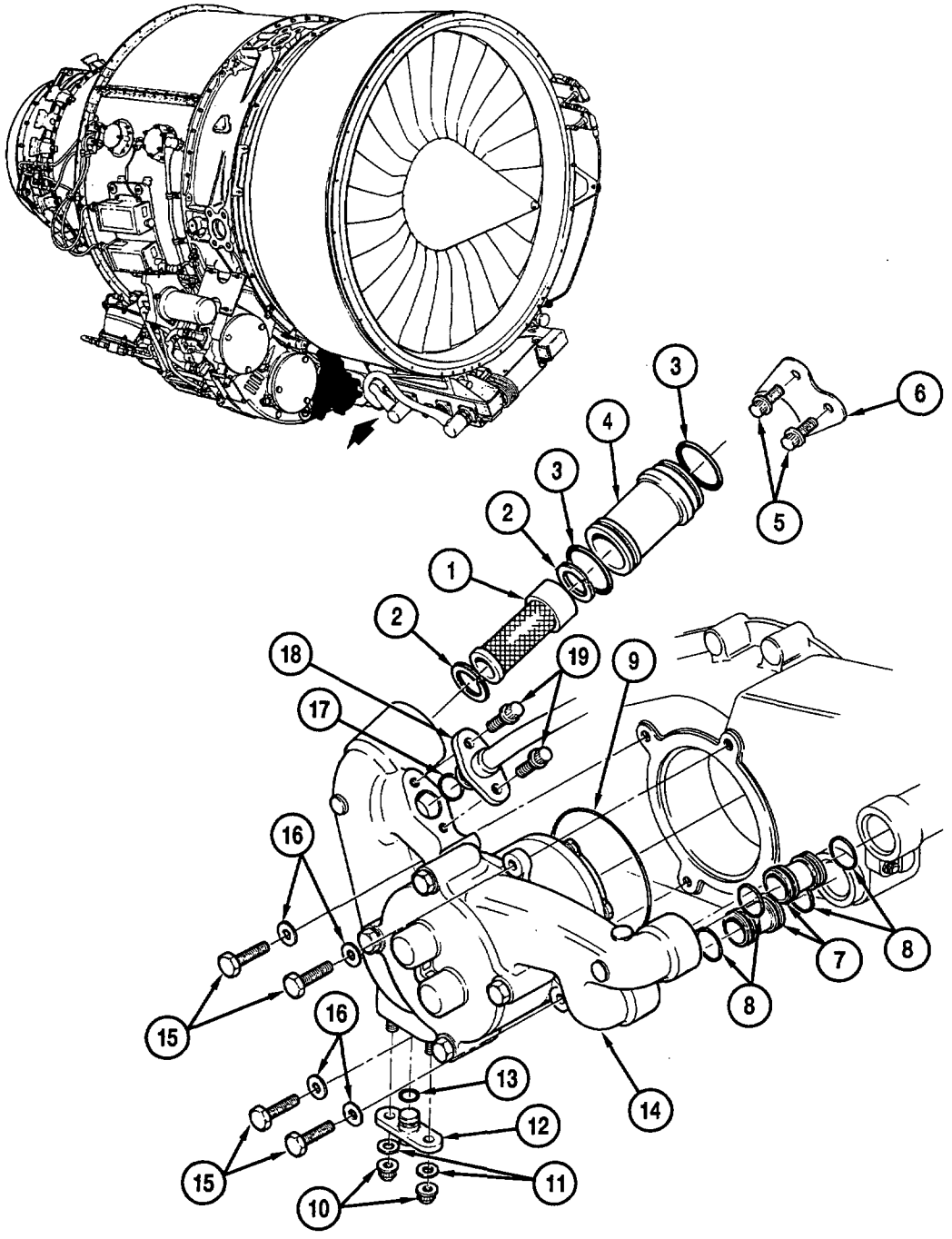
      (3) Remove two bolts (19), withdraw PAV oil tube (18) and discard preformed packing (17).

      (4) Remove two bolts (5), retaining plate (6) and slide tube (4) into oil pump (14).

      (5) Remove four bolts (15), washers (16) and remove oil pump assembly (14).

      (6) Remove two transfer tubes (7) and discard preformed packings (8).

      (7) Remove transfer tube (4) from oil pump assembly (14) and discard preformed packings (3).



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Oil Pump Assembly (Pre-SB24367) - Removal/Installation
Figure 201

Key to Figure 201

1. Strainer Element
2. Retaining Ring
3. Preformed Packing
4. Transfer Tube
5. Bolt
6. Retaining Plate
7. Transfer Tube
8. Preformed Packing
9. Preformed Packing
10. Self-locking Nut
11. Washer
12. Drain Cover
13. Preformed Packing
14. Oil Pump Assembly
15. Bolt
16. Washer
17. Preformed Packing
18. PAV Bypass Oil Tube Assembly
19. Bolt

(8) Remove two retaining rings (2) and withdraw strainer element (1) from transfer tube (4).

B. Installation of Oil Pump Assembly (Pre-SB24367) (Ref. Fig. 201)

(1) Install strainer element (1) in transfer tube (4) with two retaining rings (2).

(2) Lubricate preformed packings (3) with engine oil (PWC03-001), install on transfer tube (4), and install tube into main oil supply port of oil pump assembly (14).

(3) Install preformed packing (9) on oil pump assembly (14).

(4) Install four guide pins (0.190-32 x 2.0 long) in AGB oil pump bolt holes.

CAUTION: DO NOT OVERHEAT MATING FACE OF AGB AS PACKING MAY BE DAMAGED UPON OIL PUMP ASSEMBLY.

(5) Locally heat mating face of AGB with suitable heat gun.

CAUTION: ENSURE SPLINED COUPLING SHAFT OF OIL PUMP ENGAGES WITH SCAVENGE PUMP INSIDE AGB.

(6) Align transfer tubes and install oil pump (14) on AGB.

(7) Remove guide pins and install four bolts (15) and washers (16).

(8) Torque bolts (15) in a star pattern 36 to 40 lb.in. (4.0-4.6 Nm).

(9) Push transfer tube (4) into AGB and secure with retaining plate (6) and two bolts (5). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(10) Install new preformed packing (17) on PAV oil tube (18). Install PAV tube in oil pump (14). Secure with two bolts (19) and torque 36 to 40 lb.in. (4.0-4.6 Nm).

(11) Replenish oil system (Ref. 72-00-00, SERVICING).

C. Removal of Oil Pump Assembly (Post-SB24367) (Ref. Fig. 202)

(1) Drain oil system (Ref. Chapter 72-00-00, SERVICING).

(2) Remove EEC and lower electrical bracket assembly (Ref. Chapter 73-20-02).

(3) Remove two bolts (3), retaining plate (2) and slide tube (15) into oil pump (6).

(4) Remove four bolts (12), washers (11) and remove oil pump assembly (6).

(5) Remove transfer tube (5) and discard preformed packing (4).

(6) Remove transfer tube (15) from oil pump assembly (6) and discard preformed packings (14).

(7) Remove two retaining rings (1) and withdraw strainer element (17) from transfer tube (15).

(8) If necessary, remove nuts (10), washers (9), cover (8) and preformed packing (7). Discard preformed packing.

D. Installation Oil Pump Assembly (Post-SB24367) (Ref. Fig. 202)

(1) Lubricate preformed packing (7) with engine oil (PWC03-001), install on cover (8) and install cover with washers (9) and nuts (10). Torque nuts 23 to 26 lb.in. (2.6-3.0 Nm).

(2) Install strainer element (17) in transfer tube (15) with two retaining rings (1).

(3) Lubricate preformed packings (4) with engine oil (PWC03-001), install on transfer tube (5) and install tube (5) into oil pump assembly.

(4) Lubricate preformed packings (14) with engine oil (PWC03-001), on transfer tube (15) and install tube (15) into main oil supply port of oil pump assembly (6).

(5) Lubricate preformed packing (16) with engine oil (PWC03-001), and install on oil pump assembly (6).

(6) Install four guide pins (0.190-32 x 2.0 long) in AGB oil pump bolt holes.

CAUTION: DO NOT OVERHEAT MATING FACE OF AGB AS PACKING MAY BE DAMAGED ON OIL PUMP ASSEMBLY.

(7) Locally heat mating face of AGB with suitable heat gun.

CAUTION: MAKE SURE SPLINED COUPLING SHAFT OF OIL PUMP ENGAGES WITH SCAVENGE PUMP INSIDE AGB.

(8) Align transfer tubes (15 and 5) and install oil pump (6) on AGB.

(9) Remove guide pins and install four bolts (12) and washers (11).

(10) Torque bolts (12) in a star pattern 36 to 40 lb.in. (4.0-4.6 Nm).

(11) Push transfer tube (15) into the intermediate case and secure with retaining plate (2) and two bolts (3). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(12) Replenish oil system (Ref. Chapter 72-00-00, SERVICING).

E. Removal of PAV and Cold Start Valve (Post-SB24367) (Ref. Fig. 203)

(1) Drain the engine oil from the oil tank (Ref. 72-00-00, SERVICING).

(2) Remove two nuts (9) and remove cover (10) with puller (PWC43172).

(3) Remove and discard preformed packing (11).

(4) Remove PAV and cold start valve by turning assembly counterclockwise.

(5) Compress seat (7) and spring (6) in the valve (5) with compressor (PWC60831), and remove retaining ring (8), seat (7), spring (6) and valve (5) from the sleeve (4).

F. Installation of PAV and Cold Start Valve (Post-SB24367) (Ref. Fig. 203)

(1) Assemble PAV and cold start valve as follows:

(a) Install sleeve (4) in compressor (PWC60831).

(b) Install valve (5) in sleeve (4) and position retaining ring (8) in pusher arm of tool.

(c) Install spring (6) with seat (7) in valve (5), compress seat and spring and install retaining ring (8).

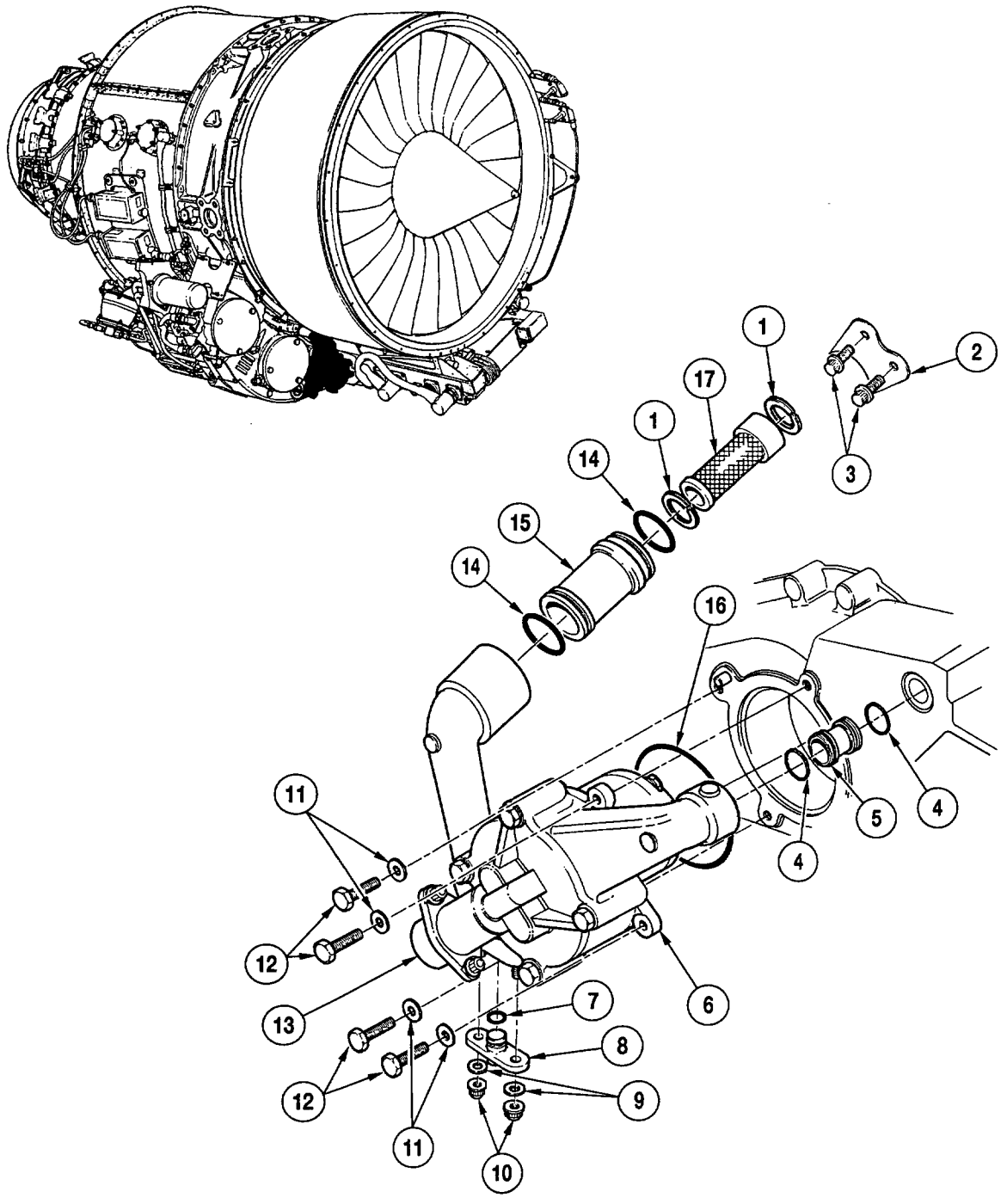
(d) Remove compressor (PWC60831).

(2) Screw in PAV and cold start valve assembly into the valve housing (3) in the oil pump cover until it seats lightly.

(3) Adjust seating by turning the valve 1 turn counterclockwise.

(4) Lubricate preformed packing (11) with engine oil (PWC03-001), install on the oil pump cover (10) and install cover with bolts (1), and nuts (9). Torque nut 23 to 26 lb.in. (2.7-3.0 Nm).

(5) Replenish engine oil (Ref. 72-00-00, SERVICING).



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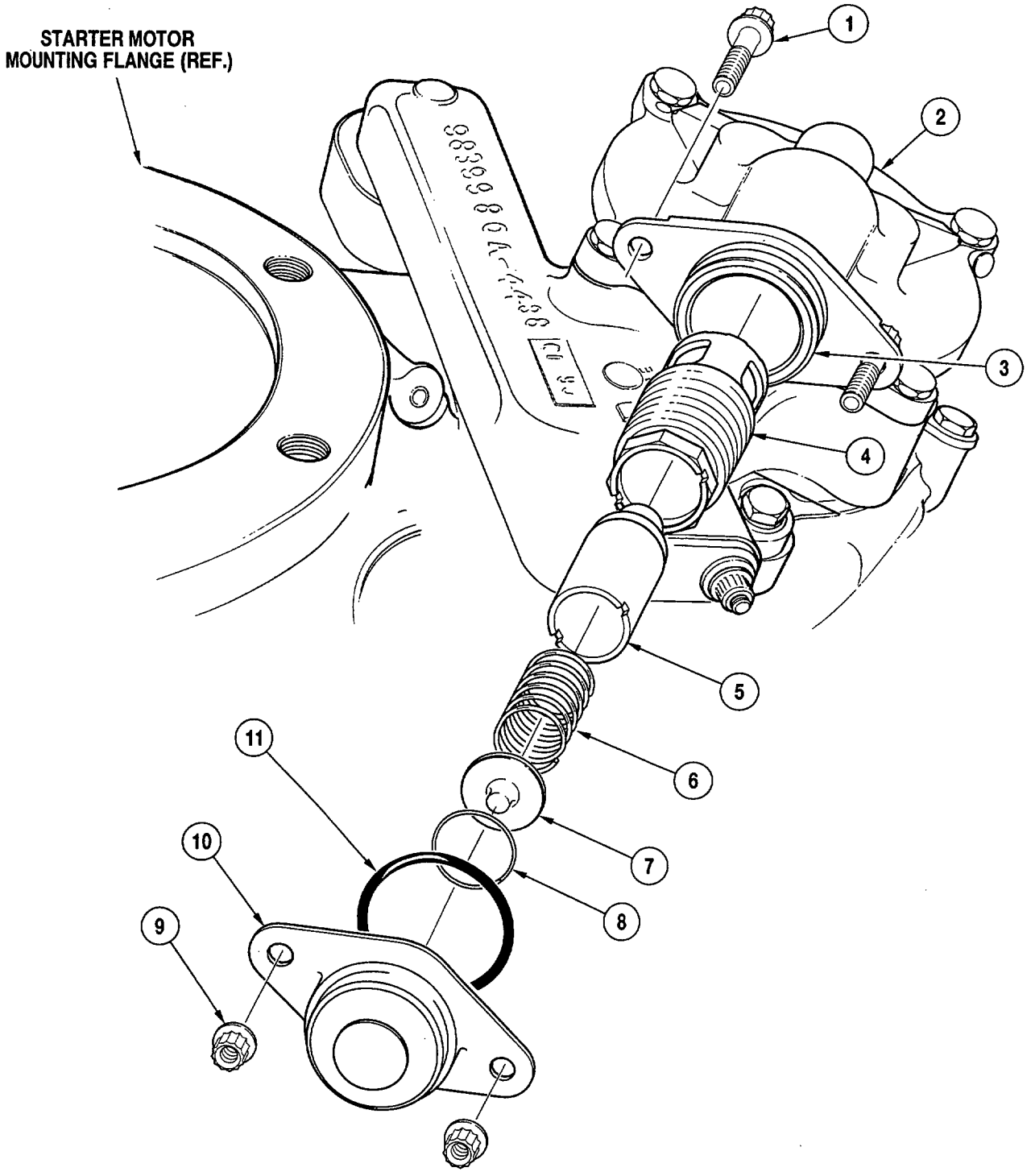
Oil Pump Assembly (Post-SB24367) - Removal/Installation
Figure 202

Key to Figure 202

1. Retaining Ring
2. Retaining Plate
3. Bolt
4. Preformed Packing
5. Transfer Tube
6. Oil Pump Assembly
7. Preformed Packing
8. Drain Cover
9. Washer
10. Self-locking Nut
11. Washer
12. Bolt
13. Pressure Adjusting and Cold Start Valve (Ref.)
14. Preformed Packing
15. Transfer Tube
16. Preformed Packing
17. Strainer Element

6. Adjustment/Test

Refer to Chapter 71-00-00 for required checks following installation of the Oil Pump and PAV/Cold Start Valve.



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PAV and Cold Start Valve (Post-SB24367) - Removal/Installation
Figure 203

Key to Figure 203

1. Bolt
2. Oil Pump Cover (Ref.)
3. Valve Housing (Ref. part of item 2)
4. Adjustable Cold Start Valve Sleeve
5. Cold Start Valve
6. Spring
7. Seat
8. Retaining Ring
9. Nut
10. Valve Cover
11. Preformed Packing

TABLE OF CONTENTS

SUBJECT	PAGE
CHIP DETECTOR - MAINTENANCE PRACTICES	**79-30-01**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Removal/Installation	201
A. Magnetic Chip Detector	201
6. Inspection/Check	201
A. Magnetic Chip Detector	201
B. Valve Housing	202
OIL PRESSURE MEASURING SYSTEM - MAINTENANCE PRACTICES	**79-30-02**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Oil Pressure Measuring System	201
A. Removal	201
B. Installation	201
OIL FILLER NECK - MAINTENANCE PRACTICES	**79-30-03**
1. General	201
2. Consumable Materials	201
3. Special Tools	201
4. Fixtures, Equipment and Supplier Tools	201
5. Oil Filler Neck (Pre-SB24021)	201
A. Removal	201

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
OIL FILLER NECK - MAINTENANCE PRACTICES (Cont'd)	**79-30-03**
B. Installation	208
6. Oil Filler Neck (PW305A Pre-SB24578)	210
A. Removal	210
B. Installation	210
7. Blanking Plate (PW305A Pre-SB24578)	210
A. Removal	210
B. Installation	211
8. Oil Level Indicator Sight Glass (Post-SB24021)	211
A. Removal	211
B. Installation	211
9. Differential Oil Pressure Indicator (Post-SB24021)	211
A. Removal	211
B. Installation	211
10. Oil Filler Cap (Post-SB24021)	213
A. Removal	213
B. Installation	213
11. Oil Filler Neck (Post-SB24021)	213
A. Removal	213
B. Installation	215
12. Oil Filler Neck (PW305A Post-SB24578)	215
A. Removal	220
B. Installation	220
13. Vent Tube (PW305A Post-SB24578)	220
A. Removal	220
B. Installation	224

P&WC Proprietary Information. Subject to the restrictions on the title page.

TABLE OF CONTENTS

SUBJECT	PAGE
OIL FILLER NECK - MAINTENANCE PRACTICES (Cont'd)	**79-30-03**
14. Oil Lever Sensor Blanking Cover (Post-SB24348)	224
A. Removal	224
B. Installation	225

P&WC Proprietary Information. Subject to the restrictions on the title page.

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Feb 27/2009
	2 blank	Feb 27/2009
Contents	1	Feb 27/2009
	2	Feb 27/2009
	3	Feb 27/2009
	4 blank	Feb 27/2009
79-30-01 Maintenance Practices	201	Jun 08/2001
	202	Jun 08/2001
79-30-02 Maintenance Practices	201	Jul 11/2003
	202	Jul 11/2003
	203	Jul 11/2003
	204	Jul 11/2003
79-30-03 Maintenance Practices	201	Feb 27/2009
	202	Feb 27/2009
	203	Feb 27/2009
	204	Feb 27/2009
	205	Feb 27/2009
	206	Feb 27/2009
	207	Feb 27/2009
	208	Feb 27/2009
	209	Feb 27/2009
	210	Feb 27/2009
	211	Feb 27/2009
	212	Feb 27/2009
	213	Feb 27/2009
	214	Feb 27/2009
	215	Feb 27/2009
	216	Feb 27/2009
	217	Feb 27/2009
	218	Feb 27/2009
	219	Feb 27/2009
	220	Feb 27/2009
	221	Feb 27/2009
	222	Feb 27/2009
	223	Feb 27/2009
	224	Feb 27/2009
	225	Feb 27/2009
	226 blank	Feb 27/2009

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CHIP DETECTOR - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   Not Applicable

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Removal/Installation

   A. Magnetic Chip Detector

      (1) Refer to 72-00-00, SERVICING.

6. Inspection/Check

   A. Magnetic Chip Detector

      (1) Inspect flats and safety wire holes for excessive wear.

      (2) Examine internal and external threads for damage.

      (3) Check that electrical connector is securely swaged in housing.

      (4) Examine terminals of electrical connector; make sure terminals are clean, secure and undamaged and that potting compound is not cracked.

      (5) Connect ohmmeter across detector output terminals and place suitable iron bar across magnetic poles. Circuit continuity must exist. Remove bar and check that open circuit is indicated.

      (6) Check that continuity resistance between each connector terminal and corresponding magnet is less than 0.5 ohms.

      (7) Check that insulation resistance between magnets and between either magnet and body is 10 megaohms minimum at 68°F (20°C).

      (8) Test magnetic poles using suitable steel weight. A minimum weight of six ounces must be lifted by the poles.

(9) If components are unserviceable, the magnetic chip detector assembly must be replaced.

B. Valve Housing

(1) Inspect flats and safety wire holes for excessive wear.

(2) Examine internal and external threads for damage.

(3) Examine valve and valve chamber for scoring or other damage.

(4) Check that bent leg of spring is undamaged and retains spring in housing.

(5) If components are unserviceable, the magnetic chip detector assembly must be replaced.

OIL PRESSURE MEASURING SYSTEM - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC05-089	Lockwire

3. Special Tools

   Not Applicable

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Oil Pressure Measuring System

   A. Removal (Ref. Fig. 201)

      (1) Disconnect airframe connections from oil tube assembly (8), air tube assembly (11) and switch (1).

      (2) Remove self-locking nut (14), bolt (17), self-locking nut (16), bracket (15) and loop clamp (18).

      (3) Remove lockwire and disconnect coupling nuts (10 and 2).

      (4) Remove air tube assembly (11).

      (5) Remove self-locking nut (12), loop clamp (13) and washer (5).

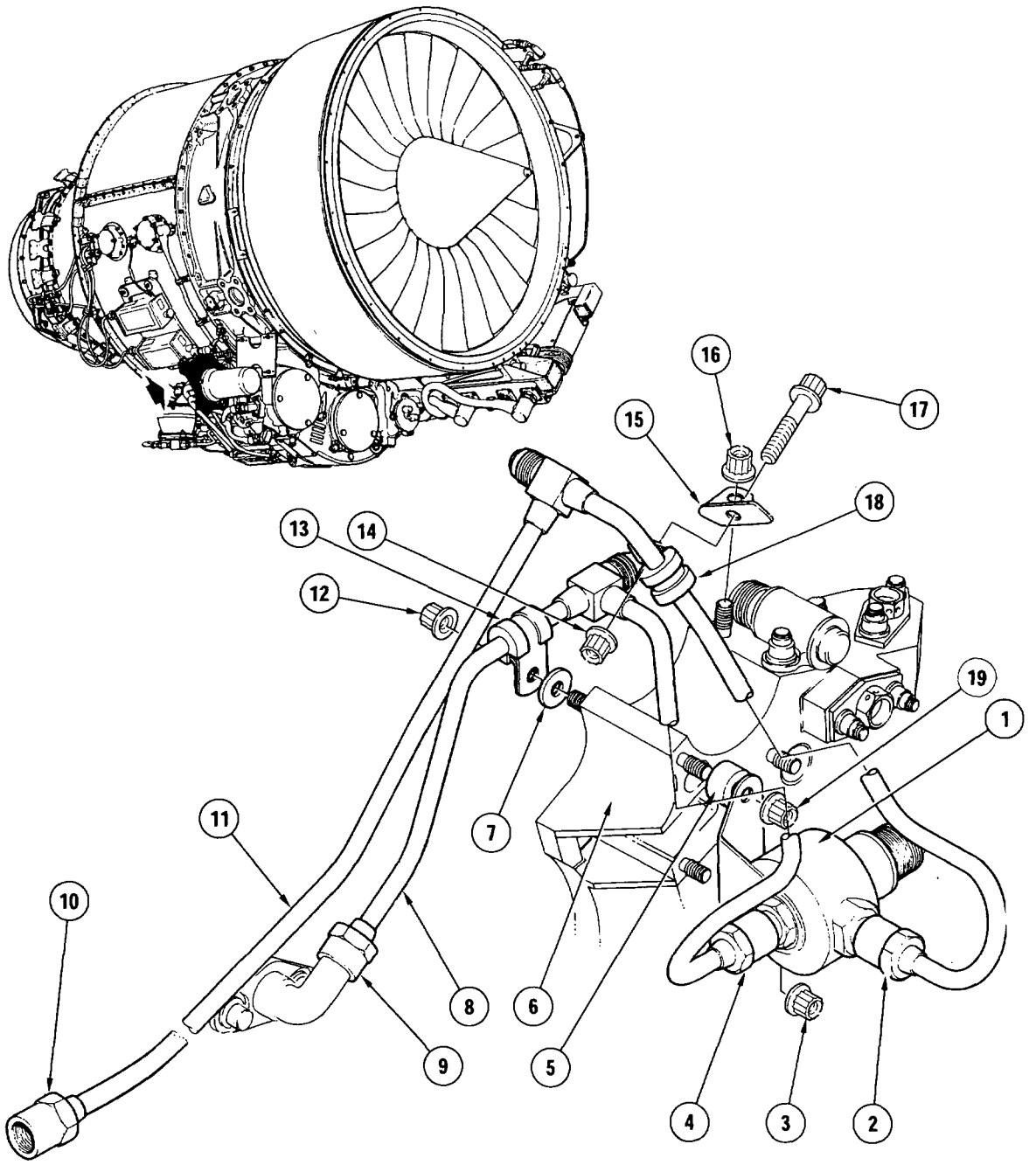
      (6) Remove lockwire and disconnect coupling nuts (9 and 4).

      (7) Remove oil tube assembly (8).

      (8) Remove self-locking nuts (3 and 19), switch (1) and two spacers (5).

   B. Installation (Ref. Fig. 201)

      (1) Position two spacers (5) on fuel filter housing (6).



**VIEW ON REAR OF
FUEL FILTER HOUSING**

C19747

Oil Pressure Measuring System - Removal/Installation
Figure 201

Key to Figure 201

1. Differential Pressure Switch
2. Coupling Nut
3. Self-locking Nut
4. Coupling Nut
5. Spacer
6. Fuel Filter Housing (Ref.)
7. Washer
8. Differential Pressure Switch Oil Tube Assembly
9. Coupling Nut
10. Coupling Nut
11. Differential Pressure Switch Air Tube Assembly
12. Self-locking Nut
13. Loop Clamp
14. Self-locking Nut
15. Bracket
16. Self-locking Nut
17. Bolt
18. Loop Clamp
19. Self-locking Nut

CAUTION: DO NOT LUBRICATE THREADS.

(2) Position switch (1) on spacers (5) and fasten with self-locking nuts (19 and 3). Torque 23 to 26 lb.in. (2.3-3.0 Nm).

(3) Position oil tube assembly (8) on switch (1). Tighten coupling nuts (4 and 9) fingertight.

CAUTION: DO NOT LUBRICATE THREADS.

(4) Position washer (7) on fuel filter housing (6). Install loop clamp (13) on oil tube assembly (8) with self-locking nut (12). Torque 23 to 26 lb.in. (2.3-3.0 Nm).

(5) Torque coupling nuts (9 and 4) 90 to 100 lb.in. (10.0-11.0 Nm).

(6) Position air tube assembly (11) on switch (1) and tighten coupling nuts (10 and 2) fingertight.

(7) Position loop clamp (18) on air tube assembly (11).

CAUTION: DO NOT LUBRICATE THREADS.

(8) Install bracket (15) on fuel filter housing (6) with self-locking nut (16). Torque 23 to 26 lb.in. (2.3-3.0 Nm).

CAUTION: DO NOT LUBRICATE THREADS.

(9) Install loop clamp (18) to bracket (15) with bolt (17) and self-locking nut (14). Torque 23 to 26 lb.in (2.3-3.0 Nm).

(10) Torque coupling nuts (10 and 2) 90 to 100 lb.in. (10.0-11.0 Nm) and install lockwire (PWC05-089).

(11) Connect airframe connections to oil tube assembly (8), air tube assembly (11) and switch (1).

OIL FILLER NECK - MAINTENANCE PRACTICES

1. General

   A. Lubricate preformed packings, threads and mating surfaces with engine oil unless otherwise stated.

   B. Install protective caps and plugs on disconnected tubes, component openings and electrical connectors after disassembly.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

   Refer to INTRODUCTION for alternate products, suppliers and suppliers addresses.

Item No.	Name
PWC03-001	Oil, Engine Lubricating
PWC05-089	Lockwire
PWC06-011	Fluid, Assembly

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC60231	Test Fixture

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Oil Filler Neck (Pre-SB24021)

   NOTE: For the oil filler neck relocation procedures, refer to 72-00-00, SERVICING.

   A. Removal (Ref. Fig. 201)

      (1) Remove the filler cap and dipstick assembly (4) from the oil filler neck (1).

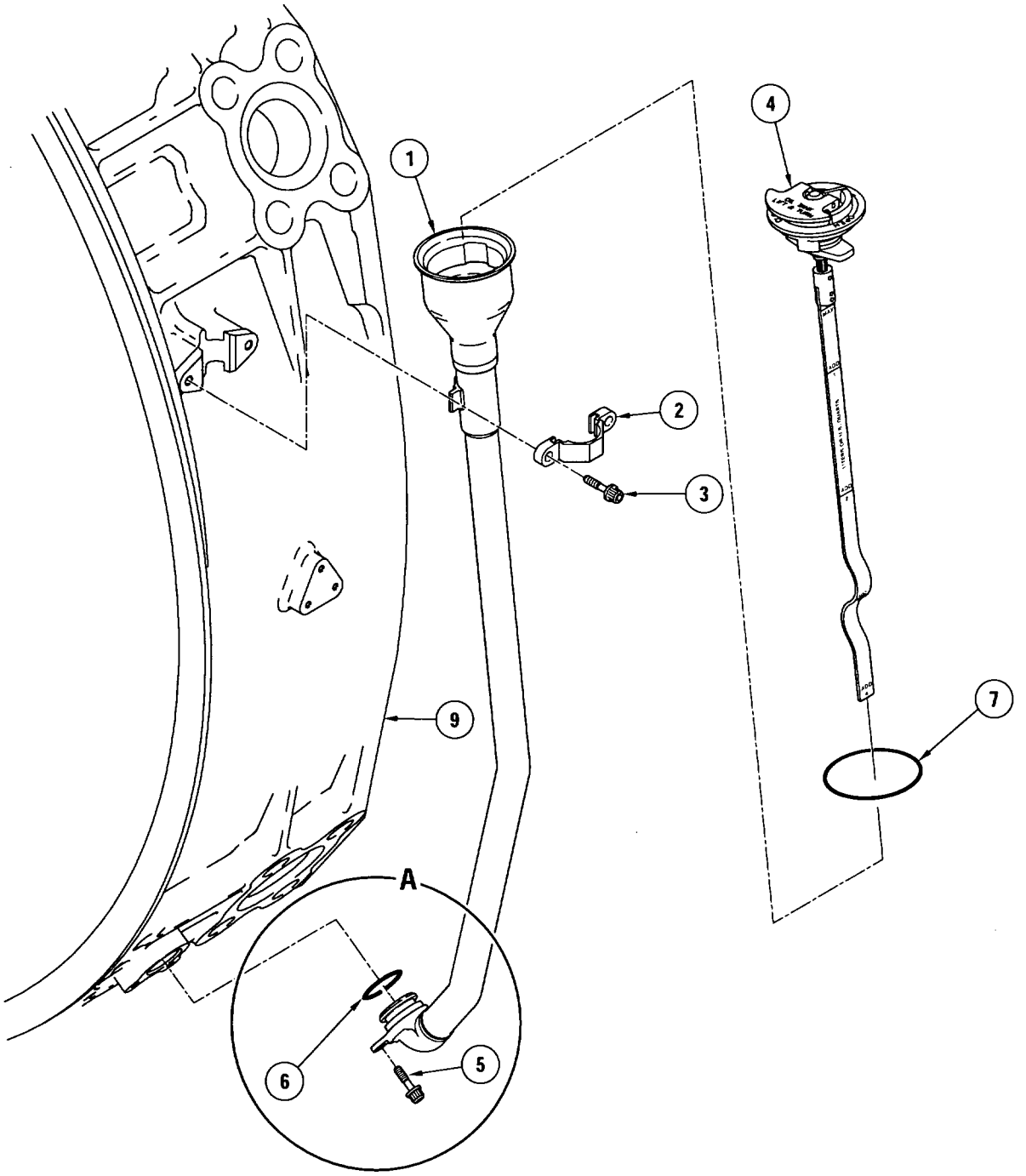
      (2) Remove and discard the packing (7).

      (3) Remove the two bolts (3) and the bracket (2) fastening the oil filler neck (1) to the intermediate case (9).

      (4) Remove the two bolts (5) from the intermediate case (9).

      (5) Remove the oil filler neck (1) from the intermediate case (9).

      (6) Remove and discard the packing (6) from the oil filler neck (1).



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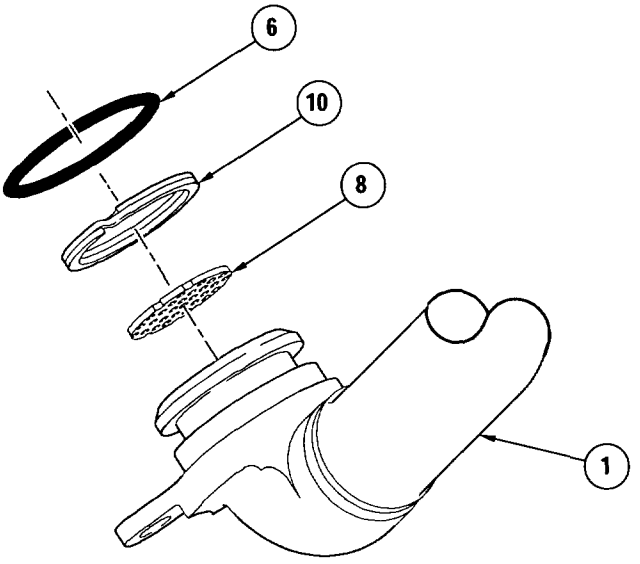
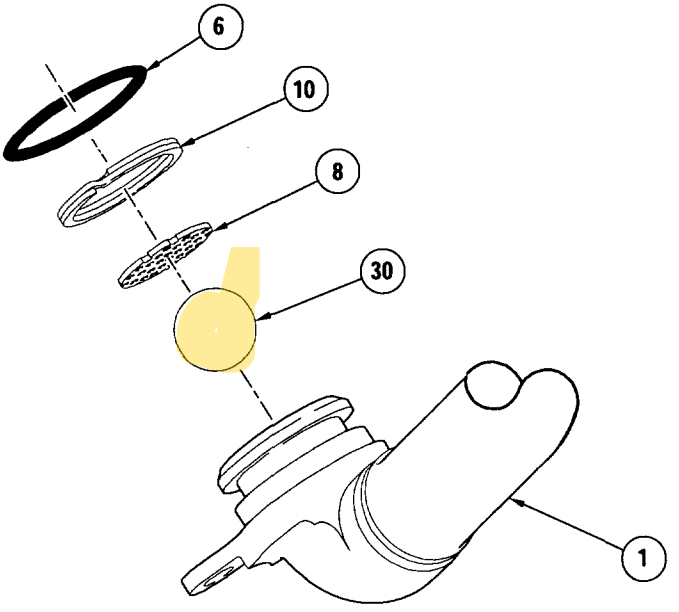
Oil Filler Neck - Removal/Installation
Figure 201 (Sheet 1 of 5)

Key to Figure 201

1. Oil Filler Neck
2. Bracket
3. Bolt
4. Filler Cap and Dipstick Assembly
5. Bolt
6. Preformed Packing
7. Preformed Packing
8. Strainer Element
9. Intermediate Case
10. Retaining Ring
11. Bolt (Pre-SB24542)
12. Vent Tube (Pre-SB24542)
13. Bracket (Pre-SB24542)
14. Loop Clamp (Pre-SB24542)
15. Bolt
16. Washer
17. Fitting (Pre-SB24542)
18. Nut
19. Bolt (Post-SB24542)
20. Bolt
21. Bolt (Pre-SB24542)
22. Nut (Pre-SB24542)
23. Indicator Housing (Pre-SB24542)
24. Preformed Packing (Pre-SB24542)
25. Differential Oil Pressure Indicator (Pre-SB24542)
26. Bolt (Pre-SB24542)
27. Bracket (Pre-SB24542)
28. Preformed Packing (Pre-SB24542)
29. Preformed Packing (Pre-SB24542)
30. Ball (PW305A Post-SB24400 and Pre-SB24422) or PW305A Post-SB24539)
31. Gasket
32. Blanking Plate (Post-SB24542)
33. Washer (Post-SB24542)
34. Gasket (Post-SB24576)
35. Gasket (Post-SB24542)
36. Gasket (Post-SB24576)



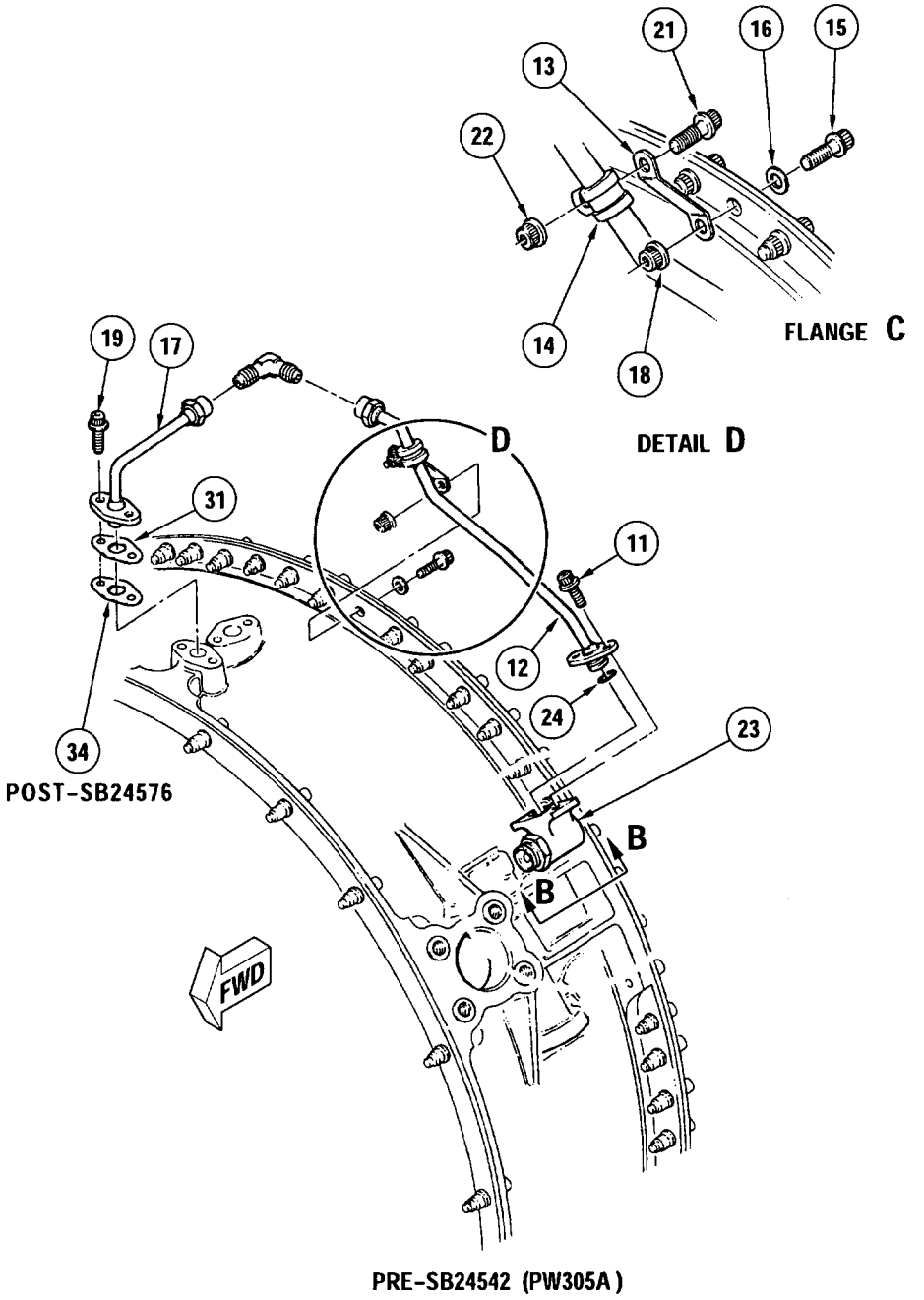
DETAIL A
PW305A PRE-SB24400
PW305A POST-SB24422 AND PRE-SB24539



DETAIL A
PW305A POST-SB24400 AND PW305A PRE-SB24422
PW305A POST-SB24539

C113514A

Oil Filler Neck - Removal/Installation
Figure 201 (Sheet 2)



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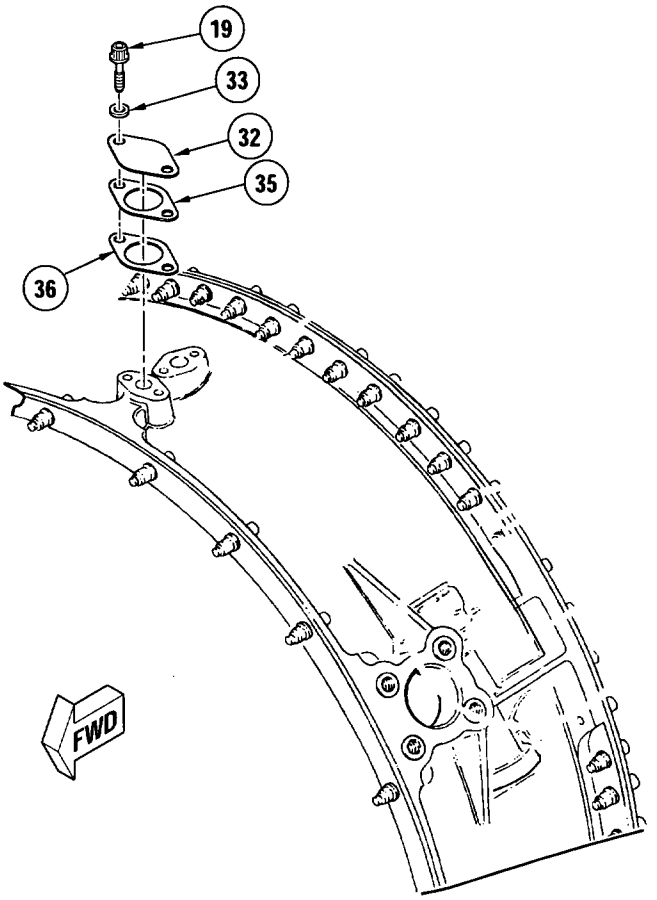
Oil Filler Neck - Removal/Installation
Figure 201 (Sheet 3)



POST-SB24542 (PW305A)

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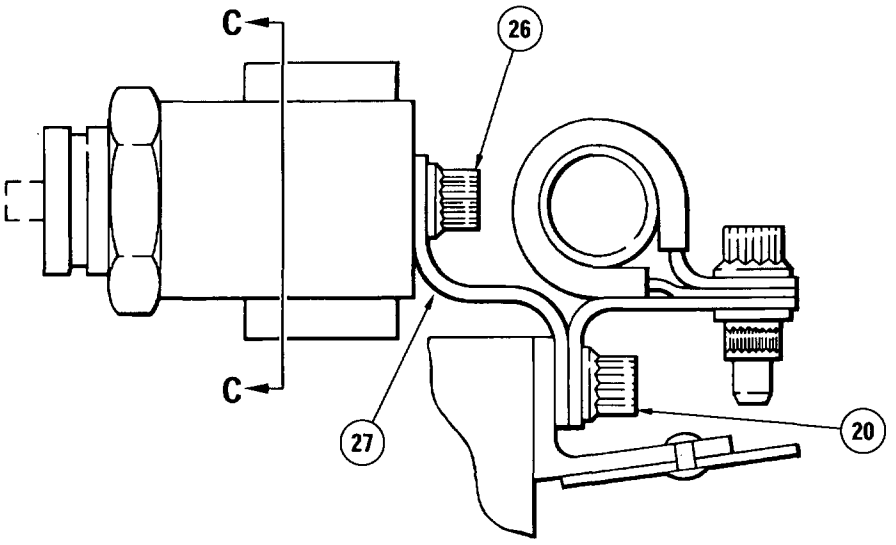
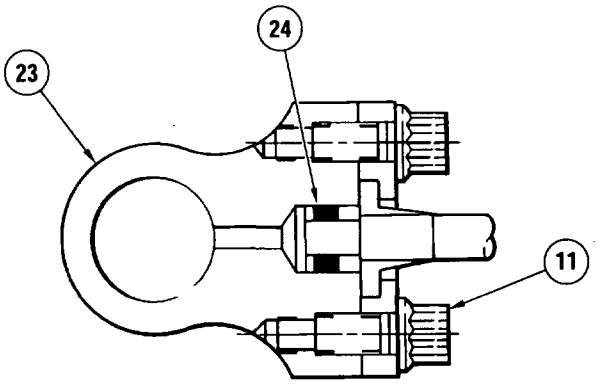
Oil Filler Neck - Removal/Installation
Figure 201 (Sheet 4)

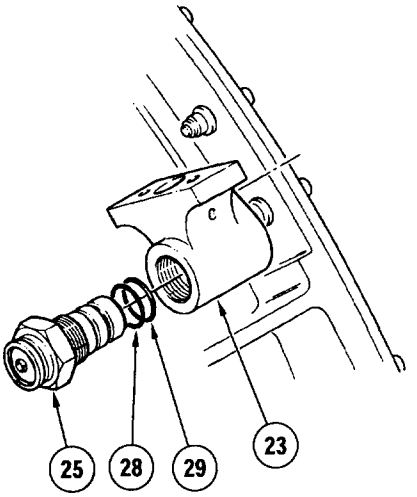


SECTION B-B



SECTION C-C

PW305A ONLY



DETAIL E

C113516

Oil Filler Neck - Removal/Installation
Figure 201 (Sheet 5)

(7) PW305A Pre-SB24400 or (PW305A Post-SB24422 and PW305A Pre-SB24539): Remove the retaining ring (10) and the strainer element (8) from the oil filler neck (1).

(8) (PW305A Post-SB24400 and Pre-SB24422) or PW305A Post-SB24539: Remove the retaining ring (10), strainer element (8) and ball (30) from the oil filler neck (1).

(9) Pre-SB24542 (PW305, PW305A and PW305B Engines):

(a) Remove the bolt (15), washer (16) and nut (18) from the bracket (13).

(b) Remove the bolt (21) and the nut (22) from the bracket (13) and the loop clamp (14).

(c) Loosen the fitting (17) and disconnect the elbow from the vent tube (12).

(d) Pre-SB24576: Remove two bolts (19), tube assembly (17) and gasket (31) from boss of the intermediate case. Discard gasket.

(e) Post-SB24576: Remove two bolts (19), tube assembly (17) and two gaskets (31 and 34) from the intermediate case. Discard gaskets.

(f) Remove the bolt (11) and the tube (12) from the indicator housing (23). Remove and discard the packing (24).

(g) Remove the bolt (20) from the intermediate case (9).

(h) Remove the bolt (26) and the pressure indicator/housing assembly (23) from the bracket (27).

(i) Remove the differential oil pressure indicator (25) from the indicator housing (23). Remove and discard the preformed packings (28 and 29).

(10) Post-SB24542:

(a) Remove the two bolts (19), two washers (33) and blanking plate (32) from the intermediate case (9).

(b) Pre-SB24576 and Post-SB24608: Remove and discard the gasket (35).

(c) Post-SB24576 and Pre-SB24608: Remove and discard the two gaskets (35 and 36).

B. Installation (Ref. Fig. 201)

(1) PW305A Pre-SB24400 or (PW305A Post-SB24422 and PW305A Pre-SB24539): Install strainer element (8) and retaining ring (10) in the oil filler neck (1).

(2) (PW305A Post-SB24400 and Pre-SB24422) or PW305A Post-SB24539: Install ball (30), strainer element (8) and retaining ring (10) in the oil filler neck (1).

(3) Lubricate preformed packing (6) with engine oil (PWC03-001) and install it on the oil filler neck (1).

(4) Install the oil filler neck (1) on the intermediate case (9) with two bolts (5). Torque the bolts 36 to 40 lb.in. (4.1-4.5 Nm).

(5) Install the bracket (2) with two bolts (3) on the oil filler neck (1) and the intermediate case (9). Torque the bolt 36 to 40 lb.in. (4.1-4.5 Nm).

(6) Lubricate preformed packing (7) with engine oil (PWC03-001) and install it on the filler cap and dipstick assembly (4).

(7) Install the filler cap and dipstick assembly (4) in the oil filler neck (1).

(8) Pre-SB24542 (PW305, PW305A and PW305B Engines):

(a) Lubricate preformed packings (28 and 29) with engine oil (PWC03-001) and install them on the differential oil pressure indicator (25).

(b) Install the differential oil pressure indicator (25) on the pressure indicator/housing assembly (23). Torque the indicator 200 to 225 lb.in. (23-25 Nm) and install lockwire (PWC05-089).

(c) Install the pressure indicator/housing assembly (23) on the bracket (27).

(d) Install the bolt (26) on the pressure indicator/housing assembly (23). Torque the bolt 24 to 36 lb.in. (2.7-4.1 Nm).

(e) Install the bolt (21) on the intermediate case (9) . Torque the bolt 36 to 40 lb.in. (4.1-4.5 Nm).

(f) Lubricate preformed packing (24) with engine oil (PWC03-001) and install it on the vent tube (12).

(g) Install the vent tube (12) on the pressure indicator/housing assembly (23) with bolt (11). Torque the bolt 24 to 36 lb.in. (2.7-4.1 Nm).

(h) Attach the tube fitting (12) to the vent tube elbow (17). Torque the fitting 90 to 100 lb.in. (10-11 Nm).

(i) Pre-SB24576: Install gasket (31) and tube assembly (18) on boss of intermediate case. Attach tube assembly with two bolts (19). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(j) Post-SB24576: Install two gaskets (31 and 34) and tube assembly (18) on boss of intermediate case. Attach tube assembly with two bolts (19). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(k) Install the washer (16), bolt (15), nut (18) and the bracket (13) on flange C. Torque the bolt 27 to 30 lb.in. (3.1-3.4 Nm).

(l) Install the loop clamp (14) on the bracket (13) with bolt (21) and the nut (22). Torque the bolt 27 to 30 lb.in. (3.1-3.4 Nm).

(9) Post-SB24542:

(a) Pre-SB24576 and Post-SB24608: Install the gasket (35), blanking plate (32), two washers (33) and two bolts (19) on the intermediate case (9). Torque bolts (19) 36 to 40 lb.in. (4.0-4.6 Nm).

(b) Post-SB24576 and Pre-SB24608: Install the two gaskets (35 and 36), blanking plate (32), two washers (33) and two bolts (19) on the intermediate case (9). Torque bolts (19) 36 to 40 lb.in. (4.0-4.6 Nm).

6. Oil Filler Neck (PW305A Pre-SB24578)

NOTE: For the oil filler neck relocation procedures, refer to 72-00-00, SERVICING.

A. Removal (Ref. Fig. 202)

(1) Remove the filler cap and dipstick assembly (4) from the oil filler neck (1).

(2) Remove and discard the packing (7).

(3) Remove the two bolts (3) and the filler neck mount bracket (2).

(4) Remove the two bolts (5) from the intermediate case (9).

(5) Remove the oil filler neck (1) from the intermediate case (9).

(6) Remove and discard the packing (6) from the oil filler neck (1).

(7) Remove the retaining ring (10), strainer element (8) and ball (11) from the oil filler neck (1).

B. Installation (Ref. Fig. 202)

(1) Install ball (11), strainer element (8) and retaining ring (10) in the oil filler neck (1).

(2) Lubricate preformed packing (6) with engine oil (PWC03-001) and install it on the oil filler neck (1).

(3) Install the oil filler neck (1) on the intermediate case (9) with two bolts (5). Torque the bolts 36 to 40 lb.in. (4.1-4.5 Nm).

(4) Install the bracket (2) with two bolts (3) on the oil filler neck (1) and the intermediate case (9). Torque the bolt 36 to 40 lb.in. (4.1-4.5 Nm).

(5) Lubricate preformed packing (7) with engine oil (PWC03-001) and install it on the filler cap and dipstick assembly (4).

(6) Install the filler cap and dipstick assembly (4) in the oil filler neck (1).

7. Blanking Plate (PW305A Pre-SB24578)

A. Removal (Ref. Fig. 203)

(1) Remove two bolts (1), two washers (2), blanking plate (3) and two gaskets (4). Discard gaskets.

B. Installation (Ref. Fig. 203)

(1) Install two gaskets (4), blanking plate (3), two washers (2) and two bolts (1) on boss of intermediate case. Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

8. Oil Level Indicator Sight Glass (Post-SB24021)

NOTE: For the oil filler neck relocation procedures, refer to 72-00-00, SERVICING.

A. Removal (Ref. Fig. 204)

(1) Remove bolts (8), cover (7), gasket (6), indicator (4) and gasket (5).

(2) Remove the oil level indicator reflector (22) or (36).

(3) Remove the Post-SB24360 floating ball (37) from the oil level indicator reflector (36).

B. Installation (Ref. Fig. 204 and 205)

(1) Wipe a thin coat of assembly fluid (PWC06-011) on the surface of the reflector (22 or 36 Fig. 204) which is in contact with the oil filler neck assembly.

(2) Install oil level indicator reflector (22 or 36).

(3) Install the Post-SB24360 floating ball (37) in the oil level indicator reflector (36).

(4) Lubricate bolts (8) with engine oil (PWC03-001) and install gasket (5), indicator (4), gasket (6), and cover (7) with bolts (8).

(5) Tighten bolts (8) in increments of 5 lb.in. (0.6 Nm) to 25lb.in. (2.8 Nm) in sequence shown (Ref. Fig. 205). Align lockwire holes and install lockwire (PWC05-089) between bolts 3 and 7, 2 and 6, 8 and 4, and 1, 5 and 9). If lockwire holes do not align, do not loosen bolts. Tighten bolt(s) sufficiently to install lockwire. Do not exceed 30 lb.in. (3.4 Nm). If bolts are loosened more than 10 lb. in. gaskets AF and AE must be replaced.

9. Differential Oil Pressure Indicator (Post-SB24021)

A. Removal (Ref. Fig. 204)

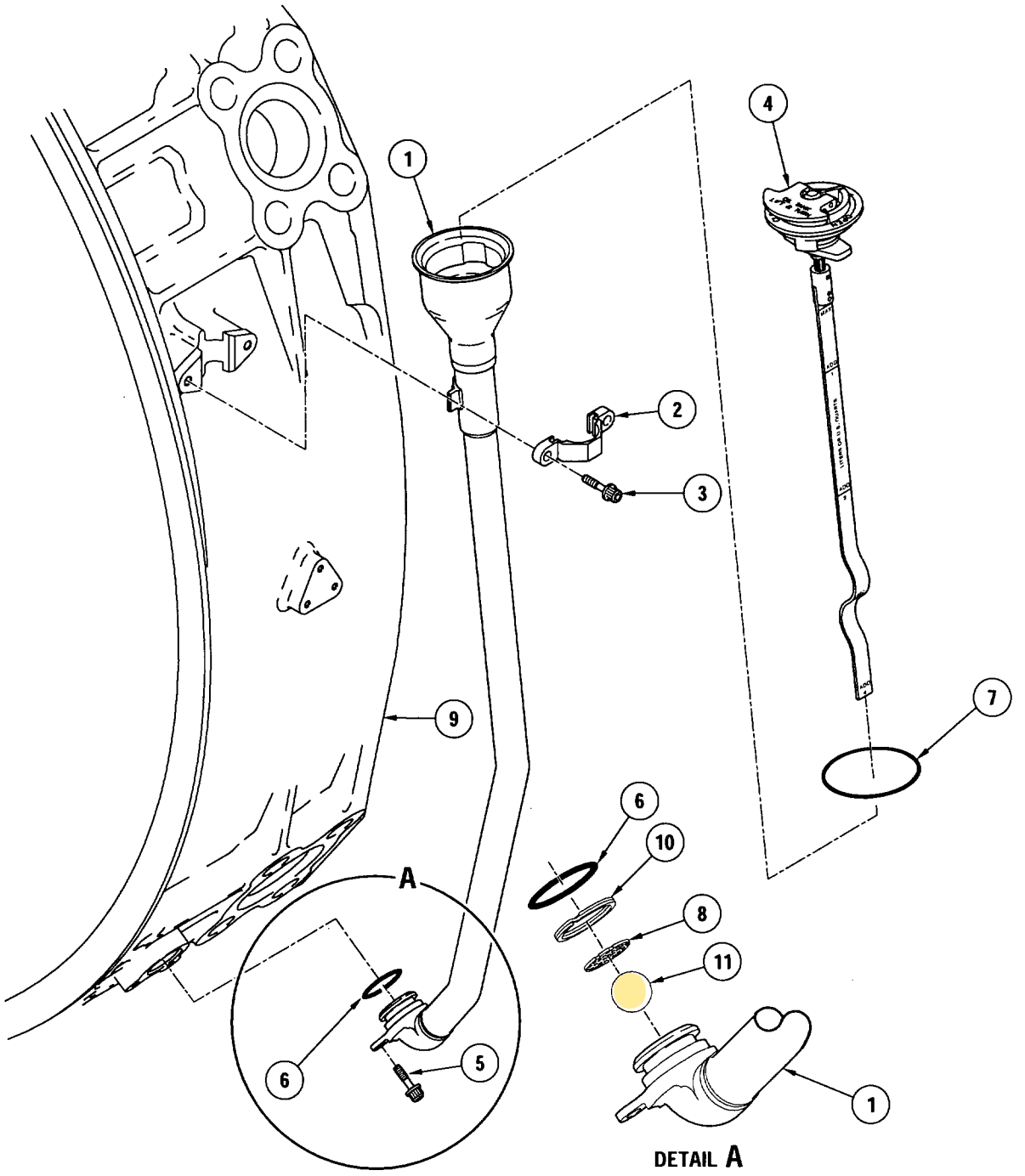
(1) Remove lockwire and unscrew oil pressure indicator (12).

(2) Remove and discard preformed packings (10 and 11).

B. Installation (Ref. Fig. 204)

(1) Lubricate new preformed packings (10 and 11) with engine oil (PWC03-001) and fit on differential oil pressure indicator (12).

(2) Install indicator (12) on filler neck assembly. Torque 200 to 225 lb.in. (23-25 Nm) and install lockwire (PWC05-089).



C149820

Oil Filler Neck - Removal/Installation (PW305A Pre-SB24578)
Figure 202

Key to Figure 202

1. Oil Filler Neck
2. Bracket
3. Bolt
4. Filler Cap and Dipstick Assembly
5. Bolt
6. Preformed Packing
7. Preformed Packing
8. Strainer Element
9. Intermediate Case
10. Retaining Ring
11. Ball

10. Oil Filler Cap (Post-SB24021)

A. Removal (Ref. Fig. 204)

(1) Remove three bolts (28), three washers (29), three nuts (30) and oil filler cap assembly (14).

(2) Remove and discard preformed packing (13).

B. Installation (Ref. Fig. 204)

(1) Lubricate new preformed packing (13) with engine oil (PWC03-001) and fit on oil filler cap assembly (14)

(2) Install filler cap to filler neck (3) with three bolts (28), three washers (29) and three nuts (30). Torque 27 to 30 lb.in. (3.0-3.4 Nm).

11. Oil Filler Neck (Post-SB24021)

NOTE: For the oil filler neck relocation procedures, refer to 72-00-00, SERVICING.

A. Removal (Ref. Fig. 204)

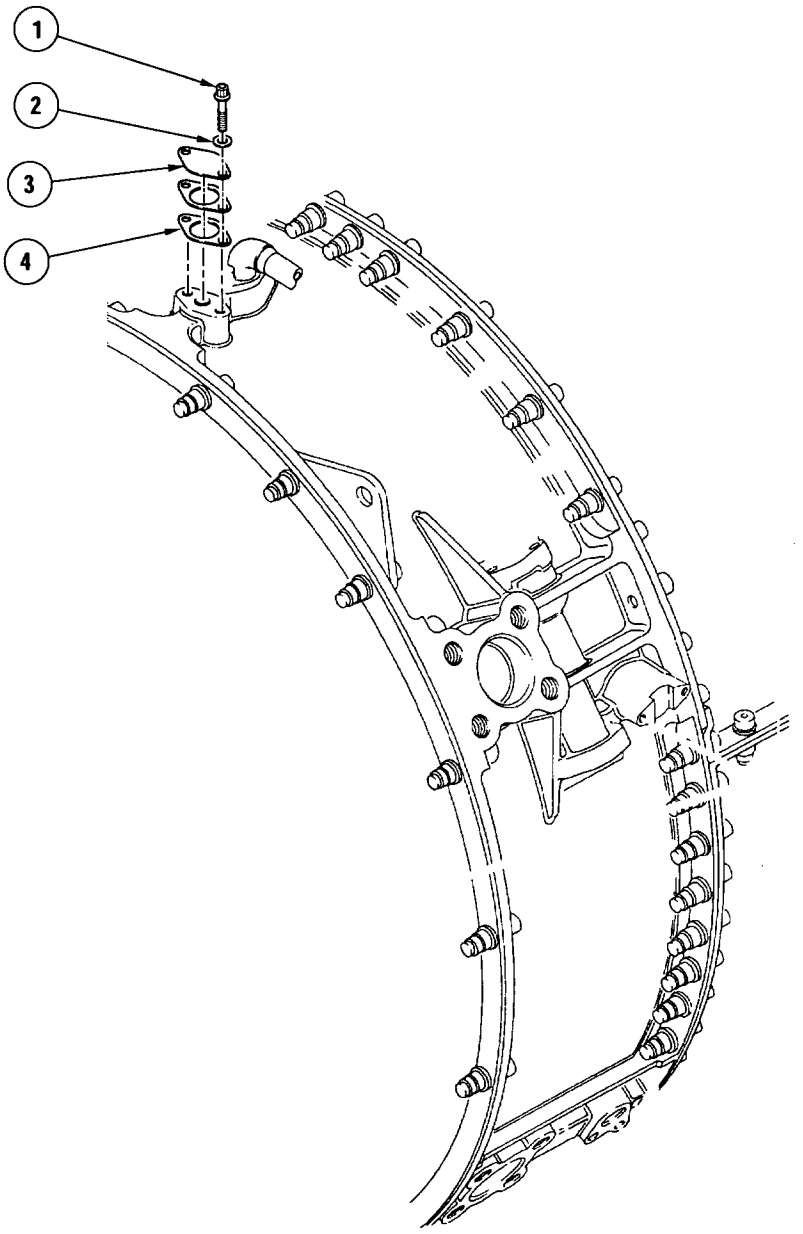
(1) Loosen tube assembly (24) and disconnect elbow fitting (21) of vent tube (16).

(2) Pre-SB24576: Remove two bolts (31), tube assembly (24) and gasket (32) from the intermediate case. Discard gasket.

(3) Post-SB24576: Remove two bolts (31), tube assembly (24) and two gaskets (32 and 43) from the intermediate case. Discard gaskets.

(4) Remove bolt (19), nut (20) and two bolts (25), and disconnect vent tube from filler neck. Remove and discard packing (15).

(5) Remove bracket (17), bolt (35), washer (34) and nut (33).



C149541

Blanking Plate - Removal/Installation (PW305A Pre-SB24578)
Figure 203

Key to Figure 203

1. Bolt
2. Washer
3. Blanking Plate
4. Gasket

(6) Remove two bolts (9), two sleeves (27), rubber support (26), two bolts (1) and filler neck from intermediate case.

(7) Remove and discard preformed packing (2).

(8) Remove mounting bracket (23) by sliding bracket out of "T" slot.

B. Installation (Ref. Fig. 204)

(1) Lubricate new preformed packing (2) with engine oil (PWC03-001) and fit on filler neck (3).

(2) Install mounting bracket (23) by sliding into the "T" slot of filler neck assembly (3).

(3) Install filler neck to intermediate case with two bolts (1) at the bottom end and two bolts (9), two sleeves (27), two rubber supports (26) at the mounting bracket (23). Torque 36 to 40 lb.in. (4.0-4.6 Nm).

(4) Lubricate new preformed packing (15) with engine oil (PWC03-001) and fit on vent tube (16).

(5) Pre-SB24576: Install gasket (32) and tube assembly (24) on the boss of intermediate case. Attach tube assembly with two bolts (31). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(6) Post-SB24576: Install two gaskets (32 and 43) and tube assembly (24) on the boss of intermediate case. Attach tube assembly with two bolts (31). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(7) Install vent tube (16) on filler neck assembly (3) with bolts (25). Torque 24 to 36 lb.in. (2.7-4.0 Nm) and install lockwire (PWC05-089).

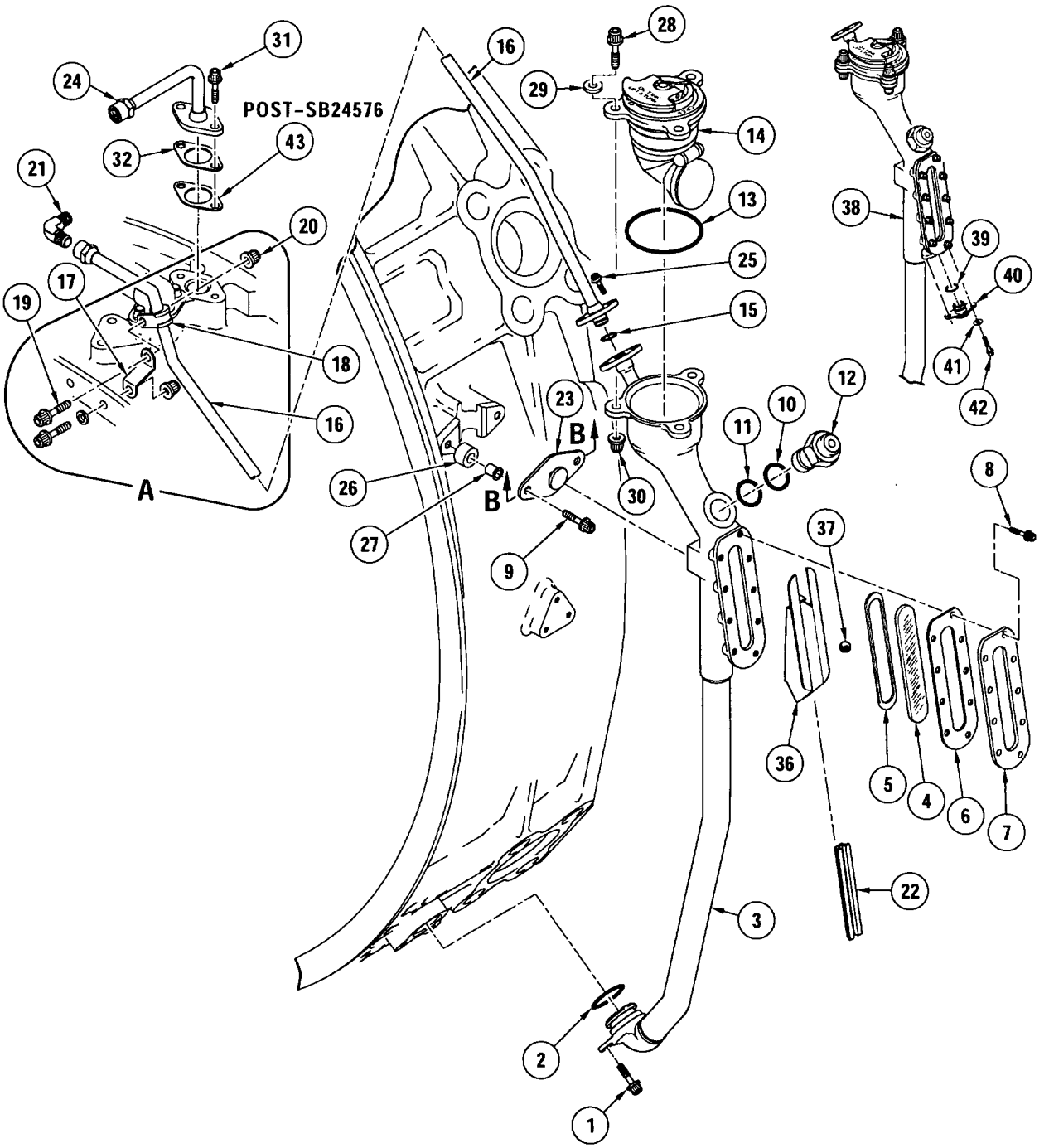
(8) Install elbow (21) to tube assembly (24). Torque 90 to 100 lb.in. (10-11 Nm) and install lockwire (PWC05-089).

(9) Install bracket (17) to Flange C with bolt (35), washer (34) and nut (33). Torque 27 to 30 lb.in. (3.1-3.4 Nm).

(10) Install loop clamp (18) on vent tube (16) and fasten to other end of bracket (17) with bolt (19) and nut (20). Torque 27 to 30 lb.in. (3.1-3.4 Nm).

12. Oil Filler Neck (PW305A Post-SB24578)

NOTE: For the oil filler neck relocation procedures, refer to 72-00-00, SERVICING.

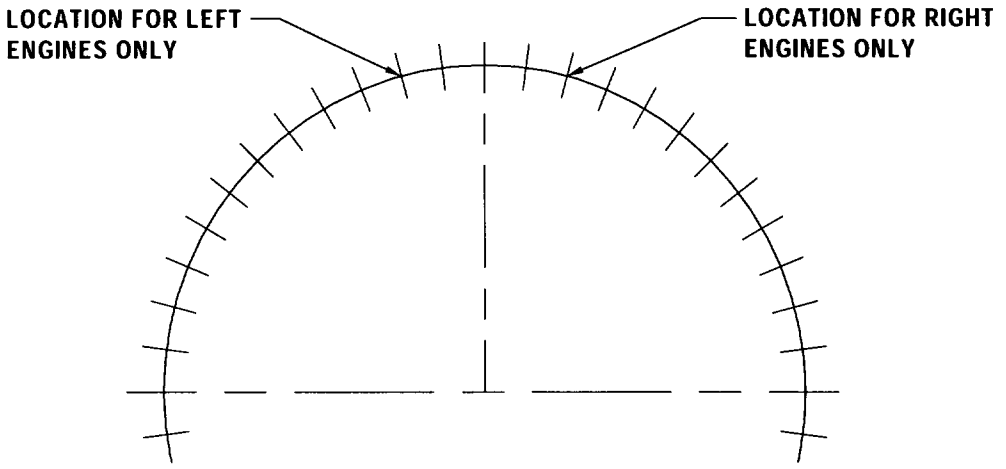


C32824D

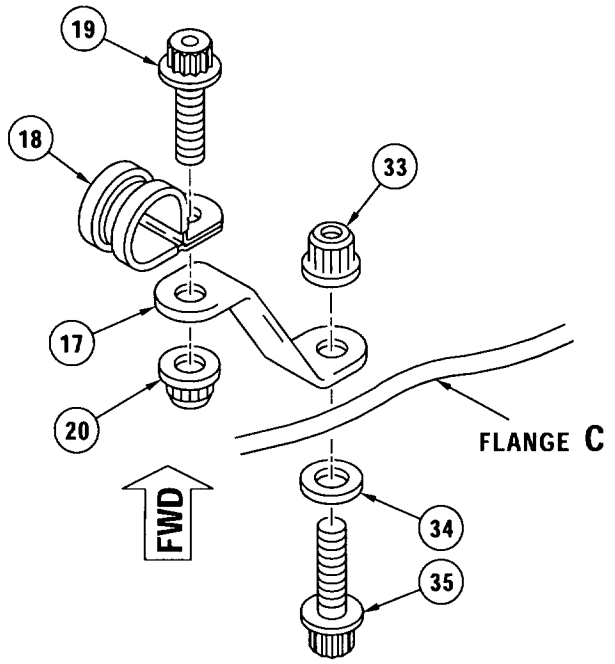
Oil Filler Neck and Related Parts - Removal/Installation (Post-SB24021)
Figure 204 (Sheet 1 of 2)

Key to Figure 204

1. Bolt
2. Preformed Packing
3. Filler Neck
4. Indicator
5. Gasket, Indicator
6. Gasket, Cover
7. Cover
8. Bolts
9. Bolts
10. Preformed Packing
11. Preformed Packing
12. Oil Pressure Indicator
13. Preformed Packing
14. Oil Filler Cap
15. Preformed Packing
16. Vent Tube
17. Bracket
18. Loop Clamp
19. Bolt
20. Self-locking Nut
21. Elbow
22. Indicator Reflector (Pre-SB24118)
23. Bracket
24. Tube Assembly
25. Bolts
26. Rubber Support (Post-SB24117)
27. Sleeve (Post-SB24117)
28. Bolt
29. Washer
30. Self-locking Nut
31. Bolt
32. Gasket
33. Self-locking Nut
34. Washer
35. Bolt (Pre-SB24117)
36. Indicator Reflector (Post-SB24118)
37. Ball (Post-SB24360)
38. Filler Neck (Post-SB24348)
39. Preformed Packing (Post-SB24348)
40. Cover (Post-SB24348)
41. Washer (Post-SB24348)
42. Bolt (Post-SB24348)
43. Gasket (Post-SB24576)

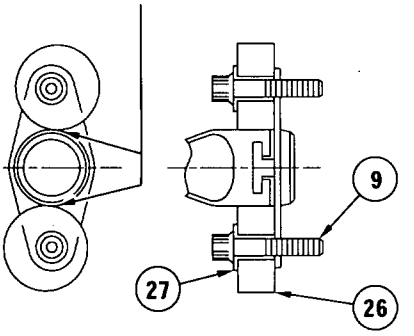


VIEW LOOKING FORWARD ON FLANGE C
SHOWING BOLT LOCATIONS



DETAIL A

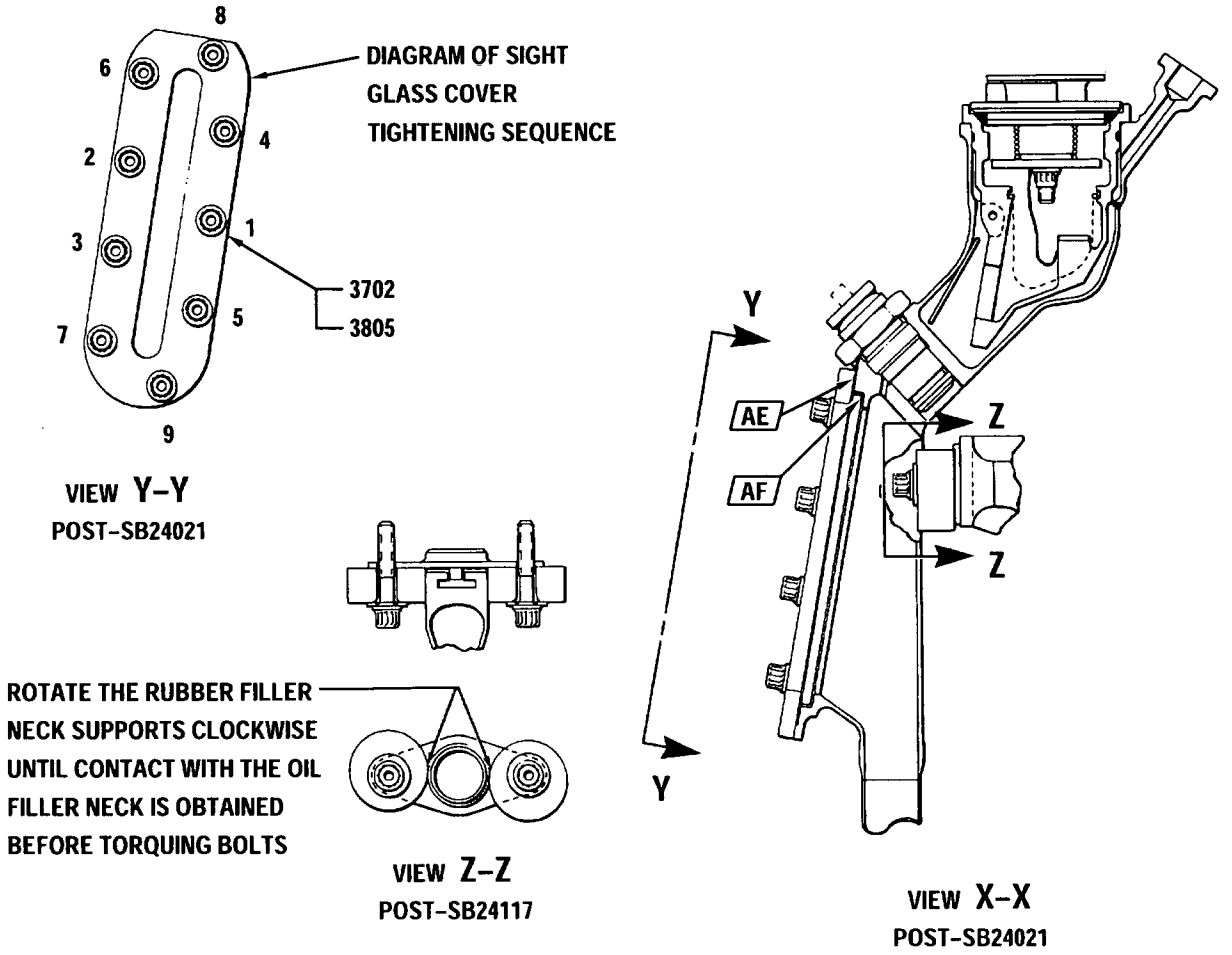
ROTATE THE RUBBER FILLER NECK SUPPORTS CLOCKWISE UNTIL CONTACT WITH THE OIL FILLER NECK IS OBTAINED BEFORE TORQUING BOLTS.



SECTION B-B
SHOWN ASSEMBLED

C32823B

Oil Filler Neck and Related Parts - Removal/Installation (Post-SB24021)
Figure 204 (Sheet 2)



C33814

Oil Level Indicator Sight Glass - Installation
Figure 205

A. Removal (Ref. Fig. 206)

(1) Drain the oil system.

(2) Remove oil tank filler cap and gage assembly (2) from oil filler neck assembly (1).

(3) Remove and discard preformed packing (3).

(4) Remove two bolts (10) and filler neck assembly (1).

(5) Remove two bolts (8) and filler neck mount bracket (9).

(6) Remove and discard preformed packing (11). Put protective covers on tube ends.

(7) Remove the retaining ring (24), strainer element (25) and ball (26) from the oil filler neck (1).

B. Installation (Ref. Fig. 206)

(1) Install ball (26), strainer element (25) and retaining ring (24) in the oil filler neck (1).

(2) Lubricate new preformed packing (11) and install on oil filler neck assembly (1).

(3) Slide filler neck mount bracket (9) into the slot of the oil filler neck assembly (1).

(4) Install oil filler neck assembly (1) on intermediate case.

NOTE: 1. Make sure the filler exit port is correctly installed in the intermediate case.

NOTE: 2. The oil filler neck assembly is installed on the left hand side of the engine. Similar installation is on the right hand side. (Ref. Fig. 206).

(5) Lubricate the threads of two bolts (8) with engine oil (PWC03-001) and install on oil filler neck assembly (1). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(6) Lubricate the threads of two bolts (10) with engine oil (PWC03-001) and attach to intermediate case. Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

(7) Lubricate new preformed packing (3) and install on filler cap and gage assembly (2).

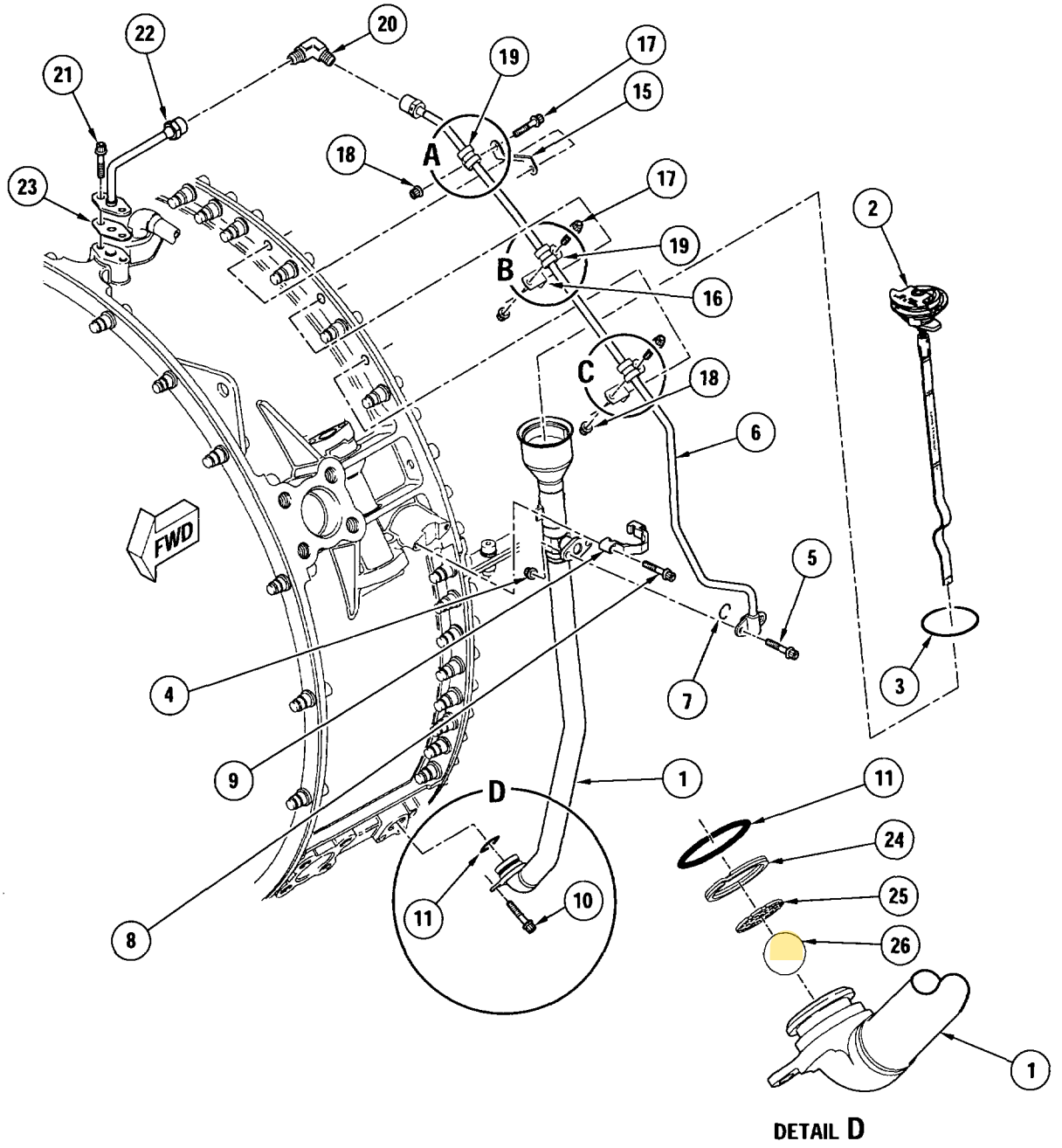
(8) Install filler cap and gage assembly (2) in oil filler neck assembly (1).

13. Vent Tube (PW305A Post-SB24578)

NOTE: For the oil filler neck relocation procedures, refer to 72-00-00, SERVICING.

A. Removal (Ref. Fig. 206)

(1) Remove bolts (17), nuts (18), loop clamps (19), bracket (15) and brackets (16).



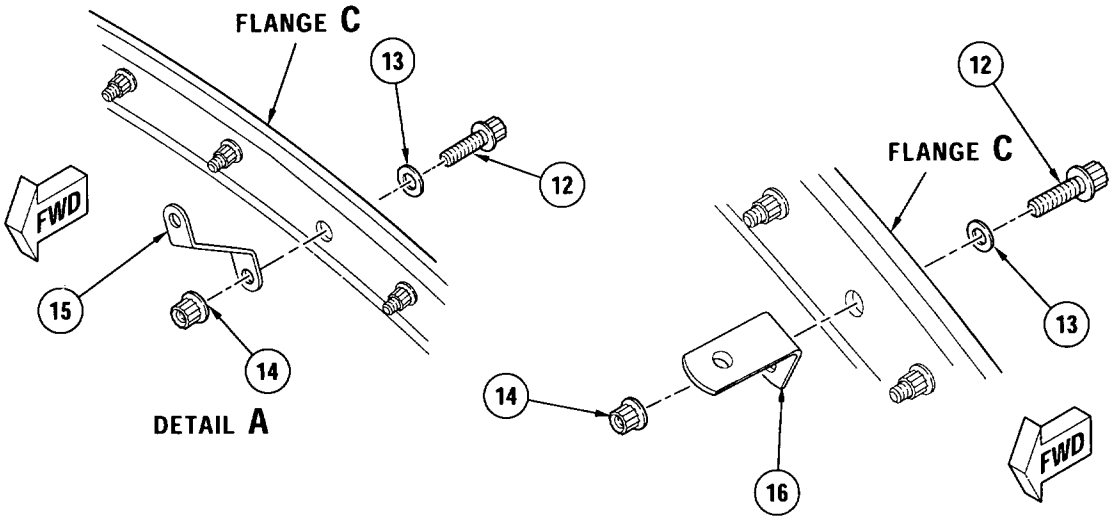
DETAIL D

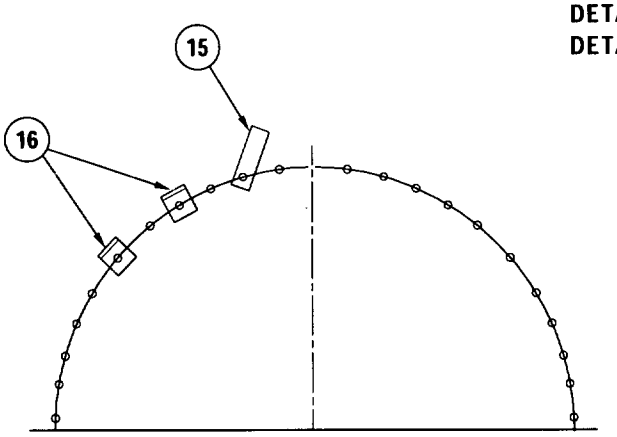
C149501A

Oil Filler Neck and Vent Tube - Removal/Installation (PW305A Post-SB24578)
Figure 206 (Sheet 1 of 2)

Key to Figure 206

1. Oil Filler Neck Assy
2. Oil Tank Filler Cap and Gage Assy
3. Preformed Packing
4. Nut
5. Bolt
6. Vent Tube Assy
7. Preformed Packing
8. Bolt
9. Filler Neck Mount Bracket
10. Bolt
11. Preformed Packing
12. Bolt
13. Washer
14. Nut
15. Loop Clamp Bracket
16. Bracket
17. Bolt
18. Nut
19. Loop Clamp
20. Elbow
21. Bolt
22. Oil Tank Vent Tube Assy
23. Gasket
24. Retaining Ring
25. Strainer Element
26. Ball





VIEW LOOKING FORWARD ON
FLANGE 'C' SHOWING BRACKET LOCATIONS

C149502

Oil Filler Neck and Vent Tube - Removal/Installation (PW305A Post-SB24578)
Figure 206 (Sheet 2)

(2) Remove bolts (12), washers (13) and nuts (14) that attach bracket (15) and brackets (16) to Flange C (Ref. Detail A and Detail B).

(3) Disconnect vent tube assembly (6) from the elbow (20). Remove elbow (20).

(4) Remove two nuts (4), two bolts (5) and disconnect vent tube assembly (6) from the oil filler neck assembly (1). Remove and discard preformed packing (7).

(5) Remove two bolts (21), oil tank vent tube assembly (22) and gasket (23). Discard gasket.

B. Installation (Ref. Fig. 206)

(1) Install gasket (23) and oil tank vent tube assembly (22) on boss of intermediate case.

(2) Apply anti-seize compound (PWC06-004) on threads of the two bolts (21) and install on boss of intermediate case. Torque bolts 27 to 30 lb.in. (3.1 to 3.4 Nm).

(3) Install elbow (20) on oil tank vent tube assembly (22).

(4) Lubricate new preformed packing (7) and install vent tube assembly (6) on oil filler neck assembly (1) and attach with two bolts (5) and two nuts (4). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

NOTE: Make sure the vent tube assembly (6) is correctly installed in the oil filler neck assembly (1).

(5) Connect elbow (20) to coupling nuts on vent tube (6, 22). Torque coupling nut 90 to 100 lb.in. (10.0 to 11.0 Nm). Attach with safety cable.

NOTE: Do not stress tubes when torquing.

(6) Install bracket (15) and two brackets (16) on front of Flange C and attach using bolt (12), washer (13) and nut (14). Tighten nut fingertight (Ref. Detail A and Detail B). Torque bolts 27 to 30 lb.in. (3.1 to 3.4 Nm).

NOTE: 1. The washers (13) must be under bolt heads.

NOTE: 2. Do not stress tubes when torquing.

(7) Install loop clamp (19) on vent tube assembly (6). Attach clamps to brackets (15 and 16) with bolt (17) and nut (18). Torque bolts 36 to 40 lb.in. (4.0 to 4.6 Nm).

NOTE: Do not stress tubes when torquing.

(8) Replenish the oil system (Ref. 72-00-00, ENGINE SERVICING).

14. Oil Lever Sensor Blanking Cover (Post-SB24348)

A. Removal (Ref. Fig. 204)

(1) Remove the bolt (42) and the washer (41) from the cover (40).

(2) Remove the cover (40) from the oil filler neck (38).

(3) Remove and discard the preformed packing (39).

B. Installation (Ref. Fig. 204)

(1) Lubricate the preformed packing (39) with engine oil (PWC03-001) and install it on the cover (40).

(2) Install the cover (40) on the oil filler neck (39) with washer (41) and the bolt (42). Torque the the bolts 36 to 40 lb.in. (4.0-4.6 Nm) and install lockwire (PWC05-089).